ROBOTICS · MICROCONTROLLERS · COMPUTER CONTROL · CIRCUITS

Nuts & Volts

EVERYTHING FOR ELECTRONICS!

March 2001
Vol. 22 No.3

Telephone Wiring Demystified

Build Your Own Voice Recognition Alarm System

Mini MIDI Monitor

Cyber-Street Survival: Email "Without A Trace"

OOPICs Get The Message

The Computers Of The Future

Move over Techno, there's a new dog in town ...

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PROFESSIONAL DISK DUPLICATION

CLONE, TEST OR REPAIR ANY HARD DRIVE

$995!

- SUPPORTS IDE, SCSI, SCA & NOTEBOOK DRIVES
- COPIES AND SERVICES HARD DRIVES
- PRINTS TEST REPORTS ON YOUR PRINTER
- DATA RECOVERY MODE BUILT-IN

Copy entire hard drives with this pro service station. Set up any SCSI or IDE drive with your original software. Attach a blank drive and press start. Make copies quickly and easily.

Use the built-in drive service system to make used drives run like new! Eliminate defective sectors, and restore hard drives to error-free condition with the factory re-mapping system. Test hard drives for top reliability using the built-in test feature. Print analysis reports on any standard parallel printer. Get the technology used by drive repair services. Call today!

25GB MP3 PLAYER

$395!
after mail-in rebate

- PLAYS OVER 10,000 SONGS FROM HARD DISK!
- PLAYS STANDARD AUDIO AND MP3 CDs AND CD-R
- DOWNLOADS MP3 FROM CD-R TO HARD DRIVE
- POWER AMPLIFIER DRIVES SPEAKERS DIRECTLY

MP3 is here! Get high performance digital sound and store over 15,000 songs on hard disk. Download over 300 songs from a single CD!

Grab new music from the net. Use your PC to create custom MP3 CDs with just the songs you like. Load them to the internal hard drive for realistic, 3-D theater sound. Patented digital signal processing gives you crystal clear sound. No PC connection is required. Connect any stereo system, or directly power external speakers. Get digital sound and room-filling bass.

The hard drive organizes your music in folders. ID-3 tags display the title, album, and artist on a large LCD. Use the jukebox feature for an entire evening of great music. Play songs randomly or in sequence from the internal hard drive. Unlike CD changers, the A/V certified 25 GB hard drive won't wear out, even under continuous use. Call now and try your MP3 player tomorrow!

COPY ANY CD NOW NO PC REQUIRED

from $995!

- MULTI-FORMAT DUPLICATION - FAST AND EASY!
- DUAL 8X DRIVES MAKE TWO COPIES AT ONCE
- INTERNAL 25GB HARD DRIVE STORES IMAGES
- PRO AUDIO MODEL HAS SP/DIFF AND ANALOG I/O

Instantly copy music and CD-ROM compact discs. Make backup copies of your favorite music and software on rugged, permanent CDs. Produce discs quickly and economically. Make custom audio CDs with just the songs you like.

Use our dual drive units to copy two CDs simultaneously, or choose the Pro Audio modelto make crystal clear music CDs from any analog or digital source. Dupe-It copiers are totally self-contained. No additional software or hardware is required. Call today for more information!

MULTI DRIVE IDE DUPLICATORS

from $495!

- COPIES EVERYTHING, PARTITIONS, O/S, THE WORKS!
- BOTH STANDARD AND ULTRA, FOUR AND SEVEN DRIVE MODELS ARE AVAILABLE NOW!
- THE ULTIMATE HIGH SPEED PRODUCTION TOOL FOR SYSTEM BUILDERS AND CORPORATE MIS

Copy entire hard drives with ease. Multi-drive duplicators are an essential tool for dealers and system builders. Why spend hours installing and formatting drives when you can dupe them instantly? Work like the pros. Get your own multi-drive, stand-alone duplicators today. CSC offers a complete line of four and seven drive copiers in both standard and ultra versions. Ultra models transfer data faster than any hard drive! Rates of over 1GB per minute are supported.

Set up any IDE drive with all your original software. Attach blank target drives, and press "start". It's that easy! You can duplicate four drives in less time than it takes to copy one on a fast PC! Your duplicate drives will be identical, bit-for-bit perfect copies, with all the files, partitions, and information on the original drive. Building systems is tough enough. Why spend hours installing software? Save time. Save money. Call today and let us Fed-X your duplicator for a risk-free evaluation!

CORPORATE SYSTEMS CENTER
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WWW.DUPEIT.COM
408 330-5524

Over 80% of the Fortune 500 depend on CSC products. Shouldn't you? Call today. Most orders ship within 24 hours! Call now for more information and a free price comparison guide. Quantity discounts are available for dealers and system builders. Copyright laws must be observed when duplicating CDs and hard drives. © 2000 CSC.

HSC Electronic Supply

Serving Silicon Valley since 1964!

...brings you a potpourri of high-tech goodies for the techno-tinkerer!
For thirty years we have been your source for Silicon Valley exotica!

Network Print Servers

- Milan 'Fastport' Model 3100
- 10BaseT, 10BaseT2 & AUI
- Serial and parallel ports
- Includes power supply and IEC cord

HSC# 18387 **$45.00**

- Milan 'Fastport' Model 3100CX
- 10BaseT Ethernet network print server
- Serial and parallel ports
- Includes power supply and IEC cord

HSC# 18386 **$42.50**

56K PCMCIA MODEM!

- 3Com/US Robitics Model MDM-XJ1560J
- 56K, V.90 PCMCIA type
- Built-in XJACK for direct phone line conn.
- New, in jewel case w/cable
- 90-day warranty
- Drivers available at: http://www.mhz.com/support/drivers.cfm?model=XJ1560

HSC# 80559 **$39.95**

Browser Mouse!

- Wheel-type browsing mouse
- 3-button PS/2 interface
- Fully programmable
- Wheel also functions as a button
- New, 90-day warranty

HSC#80555 **$4.95**

Tiny Color Camera!

- Camera-On-A-Board, measures 1.87"x 1.3"x 1" thick
- Glass micro-lens element, not pinhole
- Std. NTSC composite video output
- 350 lines horiz. res., 7 lux sens.
- 4 - 5 VDC, only 150 mA! 3-AAA batteries would power it for over six hours!
- New, in OEM pkg (no box), 90-day warranty

HSC#18209 **$59.95**

486DX4 Motherboard!

- For 486SX/DX/DX2 and DX4 CPUs
- 128KB ram on board, expandable to 512KB
- Three PCI bus slots, supports 3 master/slave
- Four ISA slots, std. AT power conn.
- DIN kybd conn, 4-72-pin SIMM skts
- On-board IDE controller & conn
- Manual, driver diskette incl.

HSC#18529 **$19.95**

SCSI Drive Cases

Just in...two new styles of SCSI drive case. Perfect for those RAID systems, server backup, or other mass storage systems! Both feature: Power and drive status LEDs, front panel off/on switch, SCSI ID switch, fan-cooled switching power supply. Attractive beige color, curved front panels. Rear panel is punched for SCSI-1 (ICN-50) daisy-chain connectors, internal SCSI cable not included. Brand new in box, 90-day warranty

- Two-bay case
- RCA Jacks/ Sound Cable incl.
- Measures 6.3" x 7.0" x 11.25"
- 80-watt power supply

HSC# 18267 **$39.95**

- Four-bay case (similar styling to two-bay case above), no sound cable
- Measures 10.3" x 7.125" x 14.3"
- 200-watt power supply

HSC#18268 **$49.95**

...and two more cases!

- 3.5" compact SCSI cabinet
- Ideal for 1" high SCSI drives
- Built-in fan-cooled power supply
- Two 50-pin Centronics daisy-chain connectors & SCSI switch on rear panel
- New, with IEC power cord, 90 day warranty

HSC# 80545 **$9.95**

- CD-ROM drive tower case, made for Compaq Computer Systems
- Can handle 7 5/25" SCSI-I/II CD-ROM drives
- Includes 200W power supply, slides for drives
- Removable front and side panels
- Solid, heavy gauge construction
- Seven-position daisy-chain ribbon cable included
- New, 90-day warranty

HSC# 80544 **$89.00**

Disk Drive Deals!

- Seagate ST31722A 1.7 GB hard drive
- Great for back-up, add-on or small dedicated systems
- IDE 40-pin connector
- Used, tested good
- Standard 1" high 3.5" form-factor
- 90-day HSC warranty

HSC# 18502 **$32.50**

- Seagate ST32171N "Barracuda Ultra-SCSI"
- 3.5" 2.16 GB hard disk drive
- 7200 RPM, 9.4 mS access time
- Packaged for Motorola product
- Brand new, with slide brackets
- OEM (Motorola) box, 90-day warranty

HSC# 18388 **$39.95**

- Seagate ST15150N 4.3 GB "Barracuda"
- 7,200 RPM, 8.0/9.0 ms avg. seek time
- 21 Hds, 11 Disks, 3,711 Cyl.
- Standard 50-pin SCSI
- Half-height size (1.5" tall)
- Refurbs, 90-day warranty

HSC# 18412 **$59.95**

USB Video Camera!

- 'NetView' PC camera w/high-speed USB interface
- Up to 30 fps for real-time video
- 350,000 pixel, 1/3 inch color CMOS
- Auto white balance & color correction
- Retail boxed, with CD
- New, 90-day warranty

HSC#80554 **$37.50**

Tablet PC!

- 486DX4-100 MHz CPU w/monochrome LCD display
- 640KB + 7168KB extended ram
- 341MB hard drive (bootable)
- Serial/Parallel/Keyboard (PS/2) ports, stylus included
- Includes battery charger, carrying case and charger

HSC#80560 **$99.00!**

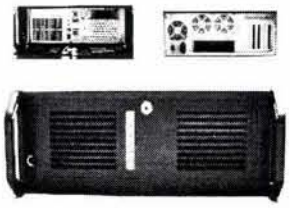
74 Min/650MB CDRs!

- Ultra high quality writeable CDs by Ricoh
- 74 minute, 650MB storage, 8X write class
- 10-piece retail pack
- Media in paper sleeves
- New, 90-day warranty

HSC#80552 **$3.95/10 pk!**

Rack-mount Chassis!

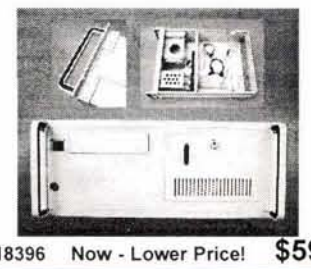
- Rugged construction for heavy duty server use
- Supports all standard ATX motherboards
- Industry standard 4U height
- 250W standard/350W surge high output supply
- Filtered cooling system, locking front panel
- Can mount up to ten drives
- Folding front handles, mounting ears & accessories
- Brand new, boxed with 90-day warranty
- Available in black or cream textured finish



HSC# 80540 **Black** **$195.00**
HSC# 80541 **Cream** **$195.00**

Do-It-Yourself Server Chassis!

- Standard 19" rack enclosure for 20-slot backplane
- 6.75"H x 24.25"D, heavy duty panels
- Brackets for 3.5" & 5.25" drives, power supply
- Front mounted 5-pin DIN with cable for keyboard
- Cabinet can be modified to accept AT-style motherboard (power extender cables included, some drilling required, no returns when drilled!)
- Hardware pack and IEC socket kit included
- Brand new, high-quality construction
- Includes 150W AT power supply!
- Inquire about higher wattage or ATX power supplies



HSC#18396 **Now - Lower Price!** **$59.00**

Headset for Gamers!

- Unique stereo headset has built-in mouse control!
- Keep your hands on the trigger buttons!
- "UR Gear" 3-dimensional "joystick" control
- Integrated stereo headphones, built-in microphone
- Even includes voice-recognition software!
- DOS, Win 3.1, Win 95 compatible, DirectX compliant
- Easy to install & use, full step-by-step manual
- 3-D position sense & movement detection
- 4-button hand control as well as voice command!
- Infrared pickup installs on monitor, parallel interface
- HSC 90-day warranty

HSC#18476 **$49.95**

Soft-Touch Keyboard!

- 'Windows 98' keyboard
- Large 'Enter', 'Spacebar' and 'Backspace' keys
- Four extra color-coded keys for: - Soft Power On - 'Sleep' mode - Wake Up - Function -
- New, 90-day warranty

HSC#80551 **$12.50**

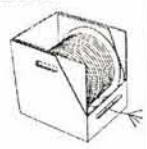
Removable HD Rack!

- Takes all standard 3.5" IDE drives, very high quality
- Also takes UDMA/100,/66 and /33 devices.
- Mounts in 5.25 inch bay, twin cooling fans
- Includes dustcover and keylock (2 keys incl.)
- New, retail boxed, 90-day warranty

HSC#80553 **$14.95**

Cat5 Cable

- 350+ Enhanced CAT5e 100MHz Horiz. cable
- Four pair, #24 AWG solid
- UL/CSA TIA/EIA 561A
- Esceeds proposed 1 GHz standards
- Available in White, Blue and Grey



HSC#5E8XX1001 **$59.95/1000'**

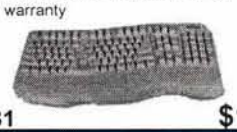
21st Century Keyboards!

Are you still typing on a keyboard that was developed in the 70's? Try one of these modern computer keyboards and you will never go back to the old days!

- Samsung SEM-MA2 124-Key Internet Keyboard
- USB connector, ergo wrist-rest included
- 20 specialized keys let you navigate the web, start programs, control your CD, much much more!!
- New, 90-day warranty

HSC#18630 **$14.95**

- Samsung Zoom 109-Key Ergo Keyboard
- PS/2 (Mini-DIN) connector
- Wristpad helps prevent wrist injuries, increases typing speed with special ergonomic design
- New, 90-day warranty



HSC#18631 **$14.95**

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- Changes are coming to our website...stay tuned!
- Simply point your browser to *http://www.halted.com*
- We plan secure shopping, with shopping basket!
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Weekly Web Specials!

- A new section has been added to our web page!
- Simply go to www.halted.com and click the top button!
- Items from our ads, as well as non-advertised items
- Also, you can download our catalog as Adobe PDF files

Terms: Some quantities limited; all items subject to prior sale. Minimum order: $10.00 plus shipping. Orders under $20.00 subject to $2.00 handling fee, in addition to shipping. All orders shipped FOB Santa Clara, CA (this means you pay freight!) by UPS Surface (no P.O. Boxes) unless otherwise specified, in which case prevailing carrier rate plus $5.00 handling fee applies. Prepaid orders that don't include shipping charges will be shipped freight COD. There is a $5.00 UPS charge added to shipping charges for COD shipments. If you have questions about your order, please call Customer Service at (408) 732-1854 M-F 9AM to 5PM PST.

Circle #59 on the Reader Service Card.

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P.O. Box 12685 Lake Park, Fl. 33403
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LAPTOP COMPUTER CARRYING CASE

Targus Notepac Plus padded case with non skid rubber feet & nylon zippers. Features padded computer compartment, expanding file pocket, 2 CD pockets,Disk pocket holds four 3.5" floppies, pocket for 2 PC cards, Workstation section has pockets for cell phone, disks, pens, 3 section accordion file for papers.
For computers up to 15" X 10.6" X 2.8" **WT:** 3.1

12786-CP ..... TARGUS LAPTOP CARRY CASE $34.95

INDUSTRIAL POWER SUPPLIES

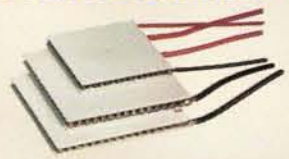
60W/100/150W

200W

Input: 110-240 VAC 50/60Hz
Specifications/Features: Enclosed switching supplies. .5% line, 1% load reg. 1% P/P noise/Ripple. Overload &overvoltage protected. Screw terminals. UL Listed.

12411-PS	5VDC/12A	$29.95	12422-PS	12VDC/12.5A	$44.95
12412-PS	12VDC/5A	$32.95	12424-PS	24VDC/6.5A	$44.95
12414-PS	4VDC/2.5A	$32.95	12425-PS	48VDC/3.3A	$44.95
12417-PS	12VDC/8.5A	$39.95	12611-PS	12VDC/17A	$59.95
12418-PS	24VDC/4.5A	$39.95	12613-PS	24VDC/8.5A	$59.95

12V THERMOELECTRIC COOLING MODULES



127 Couple Peltier Modules Optimized for 12VDC.

70W (~170 BTU) heat pumping possible. 8A max, 16V max, Draws 6A@ 12VDC
L: 1-11/16" **W:** 1-9/16" **T:** .127" **WT:** .06
12326-PM ..... 70W Module $17.95
50W (~125 BTU) heat pumping possible. 5.5A max, 16V max, Draws 4.8A@ 12VDC
L: 1-11/16" **W:** 1-9/16" **T:** .18" **WT:** .06
9080-PM ..... 50W Module $14.95
38W (~90 BTU) heat pumping possible. 3.9A max, 16V max, Draws 3A@ 12VDC
L: 1-3/16" **W:** 1-3/16" **T:** .13" **WT:** .03
12323-PM ..... 38W Module $11.95

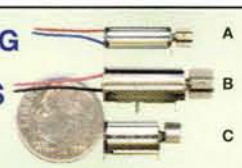
DIGITAL PANEL METERS

3-1/2 digit, 200.0mV DC basic input, .8" character height, DPMs with black plastic face. adj. decimal point, auto polarity, >10Mohm input imp. 2 readings/sec., 0.5% accuracy. Snap-in panel mounting. **5VDC powered.** Power must be isolated from input. NOTE: THESE METERS CANNOT MONITOR THEIR OWN POWER. Built in scaling resistors for 20V & 200V ranges
W: 3-3/8" **H:** 1-5/8" **D:** 1" O/A **WT:** .13
12306-ME ..... 5V LCD Meter $9.95
12308-ME ..... 5V LED Meter $12.95

DATA SWITCHES

Two set types available:
Computer sharing Set connects 2 printers to a computer. Includes: Heavy duty, metal cased A/B switch with DB-25 F connectors; One 6ft. DB-25M to DB-25M cable & two6ft. DB-25M to Centronics Cables. Printer sharing Set connects 2 computers to a printer. Includes: Heavy duty, metal cased A/B switch with DB-25 F connectors; Two 6ft. DB-25M to DB-25M cables & One 6ft. DB-25M to Centronics Cable.
WT: 2.9
12692-SW ..... Two Printer Set $5.95
12694-SW .... Two Computer Set $5.95

VIBRATING PAGER MOTORS

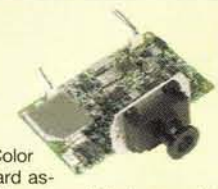


Rated 1.3VDC, 75mA running, max. **WT:** .007
A: 12342-MD: 10000 RPM. 4mm dia X 16.2mm Long, 1" leads, Metal bracket with mounting tabs
12342-MD ..... 4mm Pager Motor $2.95
B: 12343-MD: 7500 RPM, 6mm dia. X 20.6mm long, 1" leads, Metal bracket with mounting tabs
12343-MD ..... 6mm Pager Motor $1.95
C: 12344-MD: 8000 RPM, 6mm dia, X 14.4mm long. PC solder tabs
12344-MD ..... PC Pager Motor $1.95

LCD PANEL METER

3-1/2 digit Meter with 200mV input, .5" char. Ht., Adj. decimal point, auto polarity indicator, >100M ohm input impedance, 2 samples/sec. .;5% +-1 digit accuracy. Requires isolated 9VDC power.
W: 2-5/8" **H:** 1-3/4" **D:** 3/8" **WT:** .1
6929-ME ..... LCD Meter $7.95
(25+ @ $6.40 100+ @ $5.95)

SONY COLOR CAMERA



Sony CCB-GL5 1/3" Color board camera. 2 board assembly with sensor/lens board that connector mounts at right angle to main board. Lens: 6.5mm. Resolution: H-320 V-350 lines. Min sensitivity: 5lux. Scanning: 525 lines; 2:1 interlace @ 30 frames/sec. 1V P/P NTSC composite video out. 9VDC @ 175ma power.
Sensor: L: 2" W: 13/16" D: 1-1/4
Main: L: 3-3/8" W: 2-3/16" D: 5/16
WT: .1
12742-ST ..... Sony Camera $49.95

2.4VDC MINI MOTOR

Mabuchi FF-N20PN DC motor rated 1.5-3.0VDC, 2.4V nominal. 15800 RPM, 96mA (no load) @ 2.4V, 1mm dia. X 4mm shaft. Ideal hobby or toy motor.
L: 5/8" **Dia:** 1/2" **WT:** .009
12798-MD ..... 2.4VDC Mabuchi $1.49

24VDC PANCAKE MOTOR

24VDC pancake motor with tach. output. Front & rear ball bearings. Draws 120mA no load, 5A stall current @ 24V, 4325 RPM, 2225RPM @ 12VDC. 1/4" X 1-1/8" steel shaft with a pinned belt drive sprocket. 7" wire leads.
D: 4" **T:** 3" **WT:** 1.5
12771-MD ..... Pancake Motor $9.95

12 VDC TOOL MOTOR

Tool grade Johnson 12VDC motor with Bronze sleeve bearings. 10000+RPM ,2A, no load, @12V. 1/8" dia. X 5/16" steel shaft. .187" Quick connect terminals
L: 2-1/2" **Dia:** 1-7/16" **WT:** .48
12802-MD ..... 12V Tool Motor $3.95

12 VDC MOTOR

Johnson 12VDC motor with Bronze sleeve bearings. Used in hand vacs etc. 10000+RPM, 1A, no load, @12V. 1/8" dia. X 5/16" steel shaft. Solder terminals.
L: 2-1/4" **Dia:** 1-7/16" **WT:** .33
12800-MD .... 12V Johnson Motor $3.95

13.5V @ 20A TRANSFORMER

Input: 115 VAC 60Hz
Output : 13.5VAC @ 20A
6" Wire leads on Pri.
.250 Faston on Sec.
Magnetic & Faraday shields.
L: 4-1/4" **W:** 3-1/2" **H:** 3-1/2" **WT:** 9
12788-TR ..... 20A Transformer $19.95

DC MOTOR SPEED CONTROL KIT

Designed using the 556 dual timer IC. One timer is used as an Astable multivibrator to develop Clock pulses. The other is used as a Pulse Width Modulator to control the time power is applied to the motor. Power darlington provides output drive up to 5A @ 100V DC max. Single 9-15V DC supply or separate supply for motor requiring greater than 15V.
L: 3-7/8" **W:** 2-1/4" **H:** 2-1/2" **WT:** .3
6067-KT ..... DC Speed Control $12.26

STEP MOTOR DRIVER KIT

Drive 5,6 or 8 lead Unipolar step motors rated 6-30VDC @ 1.25A or less. Onboard 5VDC regulator provides stable power to the 555 clock IC & the UCN5804B driver IC. Features: Full, 1/2 & single step modes; Standard & Wave (higher holding torque) drive; Forward/reverse switch. On board pot controls speed. 4 LEDs show winding that is energized. Ideal for those learning about step motors. K109
L: 2-5/8" **W:** 1-7/8" **H:** 1" **WT:** .1
8409-KT .... Step Motor Driver Kit $16.73

PIR MOTION DETECTOR MODULE

PIR module with only 3 connections. Dual element detector element designed for human body detection. 5-10VDC input power. Active high output with a pulse width of approx. .5 Sec. (remains active as long as there is motion). Detects motion up to 10ft. Add a small relay to interface to higher power loads.
L: 1-3/8" **W:** 1" **H:** 3/4" **WT:** .2
7860-KT ..... PIR Module $9.95

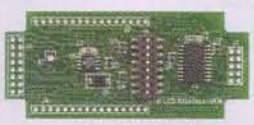
ULTRASONIC MOTION DETECTOR II KIT

Single board contains Xtal controlled osc., detector circuits and a pair of edge mounted Ultrasonic transducers. Detects motion from 4-7m away. Red LED motion indicator. Sensitivity control. Solder pad output to drive external relay or circuits. Uses 9V battery but 9VDC plug supply recommended. K-49
L: 3" **W:** 1-9/16" **H:** 5/8" **WT:** 1
6049-KT ..... Motion Detector Kit $15.61

P.C. RELAY BOARD KIT

This kit allows your P.C. to control lights, solenoids and other heavy loads found in the real world. Kit supplies external relay board, eight 12VDC relays (5A contacts) & software for use under DOS or Windows 3.1. 36 pin centronics female input connector from printer port, terminal strip for relay contacts & relay power. You supply a external 12VDC supply for relays) & printer port cable. K-74
L: 8-1/2" **W:** 2-3/4" **H:** 1" **WT:** .3
6074-KT ..... PC Relay Board Kit $35.63

UNIVERSAL LCD DRIVER BOARD



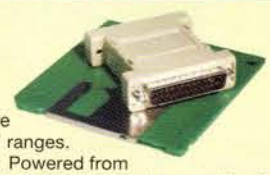
Free LCD

1 LINE X 16 CHAR. LCD DISP.

Serial driver board for 1 line X 8 character up to 4 line X 20 LCDs that use the Hitachi HD44780 controller IC. Provides all the "handshaking" needed by the LCD module. Board mounts to the back of LCD. Converts 110-19200 Baud serial data to parallel for the LCD. Access to LCD commands like scrolling, custom char. set etc. Works with Basic Stamp, PC Com Port & Single Board Computers with serial output port. Hole patterns allow use with LCDs with single row or 2 row pin configurations. Documentation.
Note that this unit is an interface and does not provide for terminal emulation; your software should "format" the data as in any LCD driver. **WT:** .1
12015-OP ..... UNIVERSAL LCD DRIVER BOARD WITH FREE 1X16 LCD $19.95

DATA SAMPLER KITS

DB-25 extended case package plugs into computer parallel port.



8 bit A/D Sampler monitors voltage changes over time. Software allows timed sampling from mS to months. Selectable 2V or 20V ranges. Useable as a low frequency digital "scope" for signals up to 5KHz. Powered from port. Includes Windows 3.1/95™ software to get started. Displays plot & data is saved as text files for import to spread sheets. Requires hard drive & VGA card to display plot.
12 Bit Analog Data Acquisition System monitors 4 digital inputs (TTL). 8 multiplexed analog inputs (0-4.096VDC. Drive external circuits with 4 TTL outputs. 'C', Visual Basic, Quick Basic routines provided along with Windows 95 software. Data can be viewed, stored or exported to Lotus or Excel. Requires external 12VDC @ < 100mA supply.
L: 2-1/4" **W:** 2-1/8" **H:** 3/4" **WT:** .1
8412-KT ..... 8 BIT DATA SAMPLER KIT $23.21
8418-KT ..... 12 BIT DATA ACQUISITION KIT $55.00

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The Computers Of The Future

by Edward B. Driscoll, Jr.

Those creaky old films like 1969's Colossus: The Forbin Project really got it all wrong (although Colossus's logo does look suspiciously like AOL's. Hmmm ...). As did the assortment of original Star Trek episodes which depicted whole planets living under the thrall of a single computer. We won't be living in a world with one supercomputer controlling our lives, as if we're Keir Dullea and Gary Lockwood in the Discovery in 2001: A Space Odyssey. What we will be living in is a world where each of us will have dozens of small computers that will seamlessly allow us to live our lives more comfortably.

What those computers will look like and will do, and how they'll be interconnected, depends on whether we'll be using them for business or for the home.

Deconstructing the Personal Computer

Let's look at the home first, where the computer is exploding, being deconstructed into its component parts – the monitor morphs into an HDTV screen, the RAM ends up in MP3 players and TV set-top boxes, the hard drives are in digital VCRs like ReplayTV and TiVo, and microprocessors are everywhere. These microprocessors will begin to be interlinked into a seamless network with PCs, appliances, and the Internet, to make the smart home a reality for millions more people than now own them.

In the mid-1970s, Steve Wozniak and Steve Jobs launched the Apple II, one of the first wildly popular personal computers. A primary reason for Woz's elegant open design was to facilitate the development of home-control devices. He was confident (if not 100% accurate) that one of the major applications for his new personal computer would be home automation. And while millions of simple X-10 devices which control lights and appliances have been sold, home automation is still by and large a hobbyist and early adopter (after 20 years!) market.

Currently, high-speed home Internet access and home networks are also in the early adopter phase. Karruna Uppal is the program manager with the Consumer Market Convergence Group of the Yankee Group, a Boston-based technology consulting and market research firm (**www.yankeegroup.com/**). She says there are about four million homes that have high-speed Internet access and of those only two million have home networks. Which means that the vast majority of the approximately 55 million home computers in the US are still accessing the Internet via poky 56k (and slower) dial-up modems.

Always on, and working at high-speeds, cable modem, DSL, or satellite will dramatically enhance the usefulness of the Internet in the home, and their spin-off technologies will begin to make "dumb" homes across the country increasingly smart, making PC-controlled X-10 modules look downright old fashioned.

Pushing from the Top

Why is the networked home such a hot topic? Danny Briere and Pat Hurley are co-authors of 1999's *Smart Homes for Dummies* (IDG Books Worldwide; ISBN: 0764505270). Briere says, "The one thing that probably most people aren't aware of, is that most of the movement towards creating smart homes is actually not being demand driven. People aren't sitting there banging at doors saying, 'I want to have a home that can do all these things.' It's really being driven by the venders and the manufacturers."

Why? In the case of the appliance manufacturers, Briere says it's because previously, their best case scenario was to sell a dryer with a maintenance agreement, "and that would be the whole relationship with the customer." But with a smart appliance that's online, a manufacturer can offer a much more sophisticated maintenance program, providing both better, faster and, in some cases, pro-active service, and additional revenue opportunities.

Additionally, as a result of the mid-1990s deregulation by the FCC, it's becoming increasingly common to see cable companies offer telephone service, or a phone company buying or merging with a cable TV company (as AT&T did a few years ago with TCI). That fabled 'last mile to the home connection' is where a lot of money is won and lost. And the more services that one company can offer a consumer, the more money they'll make, and the longer they'll keep that customer.

Gateway to the Future

With everyone wanting to sell homeowners

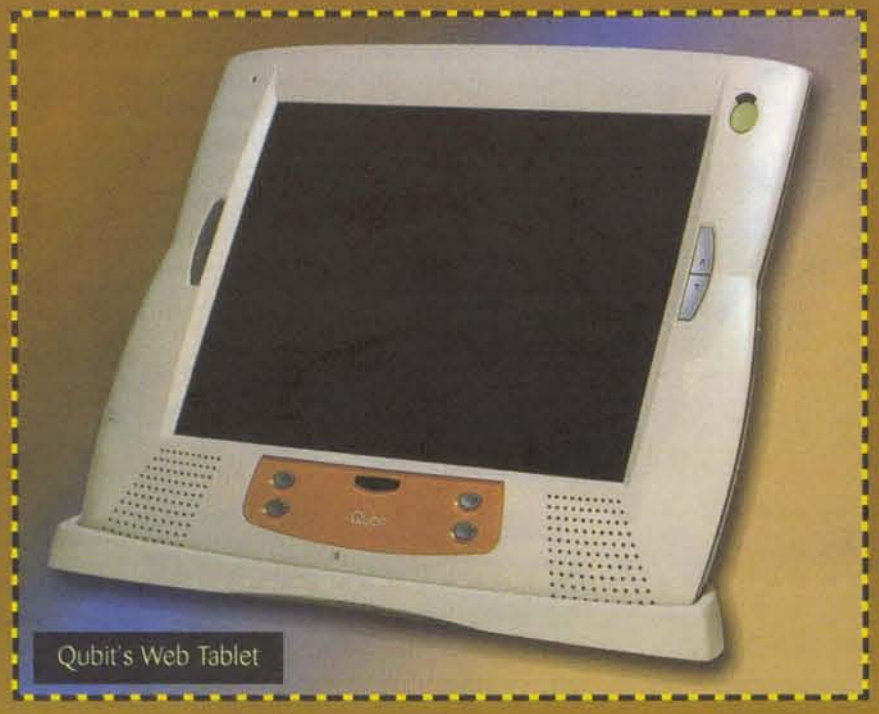
Leviton Wall Plate with two Cat-5s and two video inputs

either Internet access, or devices that plug into the Internet, an important missing puzzle piece becomes obvious, and most of these players are betting that this is a device called the *home gateway*. Numerous manufacturers are gearing up to make them.

Home gateways take the data "pipe" (or pipes) coming into the home, such as the line from a cable TV company or a satellite feed, and separates out the connections for Internet, telephone, and television, and then distributes those signals among the various devices in the home. The goal is to let every screen in the house receive any video signal, every computer (and other appliances) receive an Internet signal, and more seamlessly integrate everything. By sharing data or routing it among all the interconnected devices, the gateway acts as the brains of the whole network, steering information exactly where it needs to go.

For at least their first generation of interacting with the home gateway, "The devices on the network have to be dumb," Uppal says, "in the sense that you can't embed a lot of intelligence into a DVD player, TV, or a phone system, because that adds a lot of cost to the device, and doesn't make much sense. So you need that intelligence that sits somewhere in the network. The PC could certainly do it, in terms of having the processing power, and the intelligence to do that, but the PC is not a reliable enough device."

Implicit in Uppals' statement is the need for gateways and networks to interact with current home automation devices (such as the two-decade-old X-10 technology) and many home appliances.



Qubit's Web Tablet

Uppal says, the home gateway is "routing all of the content and services that are running around in your home. So it's going, 'Okay, this is a phone call – this goes to the phone system.' And it's a phone call for say, my spouse. So that has a different ring. And it has the intelligence to tell the phone system, 'Put this distinctive ring out, because it's a phone call for this certain person in the house.'" Additionally, the home's "phone system" might include a microphone-enabled TV set-top box in the den, and maybe an Internet telephone, in addition to the traditional phones.

Pat Hurley, *Smart Homes for Dummies* co-author, says that future home gateways will be "able to hook up to things like alarm systems and other home automation and control systems, and perhaps energy management systems. So if you're connected to a service from your energy provider, when rates are up or down, you can control when things are going to happen."

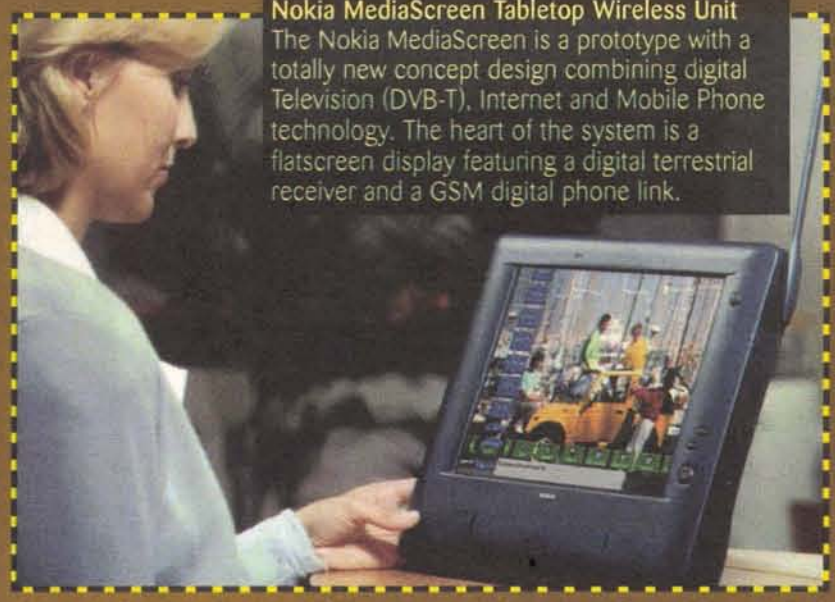
The sort of control that Hurley mentions are beyond the control of most LANs and Internet connections currently installed by early adopters. That's why Nicholas Chaklos, Director of Product Management for Ucentric Systems (**www.ucentric.com/**), says, "Early adopters, the first 5 to 10 percent of the market have strung pieces of technology together, and they're off doing their own thing. A gateway to them may not appear helpful because they've already gone through this stuff. Would they benefit from a different platform that allows more for services and applications? Absolutely – that's what they don't have today."

DigMedia's music store is a good example of the decentralized computing concept in this article. It's basically an appliance with RAM and a hard drive, but not a very sophisticated processor, dedicated to only a few functions. In this case, ripping and playing MP3s and downloading them to the portable "SoulMate" portable player.

The Tip of the Iceberg

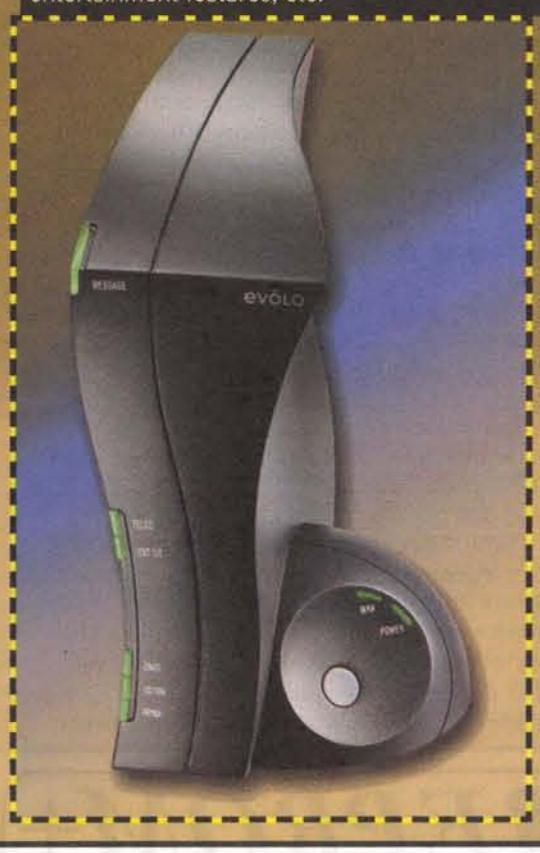
Three overriding themes emerge out of the home gateway. The first is that it's facilitating an amazingly unified group of product providers, offering products that are both interchangeable and complimentary. Karruna Uppal says, "Companies realize that in this kind of market, if they don't all work together, and are all thinking along the same track, that nothing will ever happen."

Why? Uppal believes that home networking can't impose a dozen new standards on the very appliances that consumers have been buying for decades without giving much thought about how they work, or how to make them interface with other devices. When appliances become networked enabled, Uppal believes the current ease of use



Nokia MediaScreen Tabletop Wireless Unit
The Nokia MediaScreen is a prototype with a totally new concept design combining digital Television (DVB-T), Internet and Mobile Phone technology. The heart of the system is a flatscreen display featuring a digital terrestrial receiver and a GSM digital phone link.

can't be affected without confusing or upsetting consumers. "If you want people to be networked,



Broadband Gateway's "evolvo" unit, which uses a modular approach to combine inputs for both DSL and POTS (Plain Old Telephone Service). It allows for a shared high-speed DSL connection, data networking, voice over DSL connections, a PBX-style phone network, and a firewall to keep the rest of the Internet out of your home network. Additional modules can be added to add wireless voice lines, wireless networking, more entertainment features, etc.

3Com Cable Modem

it's all about working with all of the manufacturers out there, or creating a really uniform set of standards. And that's the only way that this really takes off."

The second major trend of the home gateway is that most of these products will not be available directly to consumers, but instead are aimed at the various high-speed Internet service providers, if only because for many ISPs, the money isn't in the hardware — it's in the monthly fees. It's analogous to the first hundred years or so of the telephone. Telephone wiring and the telephones themselves were owned by, and installed in homes by the phone company, to speed their acceptance that much faster.

Finally, there is the increased need to integrate databases. Bob Steinbugler, of IBM's Corporate Strategic Design Program, says that with the growing number of Internet enabled cell phones, PDAs, laptops, Internet appliances, and traditional desktop PCs sharing databases of calendars, contacts, appointments, and notes, integrating one person or family's database into all of these devices will be increasingly important in the coming years.

Of course, the two million early adopters, who have already strung cat-5 through their homes, will have a serious leg-up on the newcomers in automating their homes, and taking advantage of the many networked products and more advanced gateway devices soon to come.

All of this means that eventually, home computers may not be just in smaller and faster boxes. Instead, the "home computer" of the future will consist of content from the Internet; very possibly applications software from the Internet; a "block box" (the gateway) with lots of brains and a large number of somewhat smart, but not quite brilliant TVs, stereos, refrigerators, email appliances, etc. In other words, the entire home will be a series of both smart and semi-smart devices, all networked into the Internet.

In the Business World

So much for the networked home. What can we expect from the computers in the workplace?

Neil Wilhelm is Director of Sun Labs California (**www.sun.com/research**) and a Sun Distinguished Engineer. He says that the corporate world is moving away from having everything on the desktop PC. Instead, Wilhelm says they're shifting towards a model where "less and less is on the desk, and more and more is now located not necessarily in a single back office, perhaps a distributed one, but nonetheless in sort of a back office kind of structure."

Wilhelm says that the motivation for this is that "people have found that these general-purpose devices are terrible to manage. Not only do they have various failure modes of their own, but the users induce additional failure modes by sticking in floppy disks, or CDs, or other things that infect it with various problems, whether it's games or viruses, or who knows what."

This is 2Wire's Home Gateway, which combines DSL and home telephone networking, plus voice over IP functions.

The New Improved Internet

One of the driving forces behind this shift in corporate computing is the ability of high-speed LANs and Internet connections to distribute programs among many computers quickly and easily.

Of course, today's PCs, and the first round of Internet appliances, are all designed around current Internet standards, which weren't intended to handle the bandwidth that applications like audio and video need to perform at their best. This is why streaming video applications such as Windows Media and Real Player look blocky and blotchy. This lack of bandwidth is also preventing a number of even more advanced business applications from getting off the ground. These applications include HDTV-quality video conferencing via the Internet, HDTV-quality video on demand, and complex Internet-enabled programs (more on those in a moment).

However, help is on the way. Internet2 **(www.internet2.edu)** is a research and development consortium of over 180 universities, about 70 companies, and 40 other organizations. Wilhelm says, "It's clear that there's going to be more and more bandwidth. People are learning better how to get more bandwidth per piece of fiber than they actually ever expected to. So we're going to have tons and tons of bandwidth, and Internet2 and so forth are ways to start exploring in advance."

Making a Fat Pipe Even Fatter

The Internet2 consortium is using high-performance networks to test new technologies and deploy new applications. "Last year, the University of Washington, working with Stanford University, Sony, and a few other companies, tested HDTV streaming video over the network," Greg Wood, Internet2's Director of Communications, says. HDTV-quality video is a colossal leap over today's streaming video, even when it's running on the highest of high-speed Internet connections. Perhaps even more importantly, the ability to transmit HDTV also means that eventually, the Internet will be able to run complex server-based programs anywhere there's a Web browser, assuming problems with latency can also be solved.

Pushing Stuff Upwards

Latency is the "one thing that's always forgotten in this discussion," Wilhelm says. It's the time between when a command is given on a computer, and something happens. On a single networked computer, that time is often in microseconds. On a computer with a slow Internet connection, that time could be several seconds, and even longer for complex programs. And this lag time is preventing lots of complex programs from being used over the Internet.

"One of the things that would be killer, of course," Wilhelm says, "is if there were an easier way to push stuff upwards. Now, this might take some rethinking, because the whole Web is oriented towards pushing it downlink – all the protocols, everything, tends to make things work that way because, of course, that's the way they thought of it when they started.

If the latency battle is won, then combined with the high-speed bandwidth of Internet2, expect some very impressive programs to be coming out of your browser, including such complex data intensive applications as CAD and video editing programs (that would allow for networking among users scattered across the country – and the globe).

Voice-activated PDAs

Reduced latency and fat bandwidth could also allow for wireless devices to be more complex, since the bulk of their programming could reside on servers on the Web. This would allow for voice commands to power wireless PDAs and cellphones. Wilhelm says, that potentially, the phone companies "would be in a position to site say, voice recognition servers appropriately around the world, around the continents, all over, wherever they have a local office, in fact, and provide that service right on the spot, with low enough latency."

Wilhelm believes that phone companies seem to have a better understanding of the latency issue than most Internet firms, because they've had years of direct experience dealing with it. "If you've ever had a satellite phone conversation, there'd be like a second and a half between when you say something and in a second and a half you get a response," he says. "It's really hard to have that conversation. But you know, in the fiber world, that's gone away."

So while home computers are going to look less like what we think of today as "computers," and more like a bunch of very clever appliances; business computing is going to involve bigger, faster, and fewer computers, with input-output devices, linked together, on everyone's desk. In other words, a smarter dumb terminal, with a much smarter server to back it up, often in a back office thousands of miles away.

Open the Garage Bay Doors, Hal ...

As we said at the beginning, those films of the 1960s got it all wrong. Colossus and HAL 9000 were the ultimate mainframes, however, thanks to Messrs. Jobs, Wozniak, and Gates, we've got lots of microcomputers all connected via an Internet. Soon, our homes will have even more microprocessor-controlled devices, themselves connected to the Internet via home gateways. They may not be as smart as ol' Hal, but combined, they'll get a helluva lot more accomplished, and be easier to maintain, too – hopefully. **NV**

The American Home, 15 Minutes into the Future

Beyond a smarter home office, what will the home LAN, a gateway, and high-speed Internet access enable? Let's step out of the home office, and walk through the rest of a home that's 15 minutes into the future (as Max Headroom would say).

In the kitchen is a refrigerator with a barcode scanner and a flatscreen Web browser of its own. The scanner keeps track of what needs to be ordered from the online grocer, and how many calories are in the food. Because the fridge is connected to the Web, if it breaks down, it will alert the repair center, and you, so that you can take appropriate steps to keep the food from spoiling in the meantime. Also in the kitchen is the microwave, which is connected to the home network so that you can easily start a cup of hot chocolate warming up, from your Web-enabled cellphone, on the drive home.

In the den, the set-top box running Microsoft firmware on top of the HDTV allows for access to the Web, video on demand, video games, Caller ID if the phone rings, e-commerce, email, and a unified set of parental controls for the TV, the 'Net, chatrooms, and video games throughout the house.

The home's lights, alarm, hot tub, and TVs, are all connected to the Web, along with cameras in each room. So is the front door and garage door, so you can see if you locked them before you left. The lights and hot tub can be turned on from your secure Web site before you leave work, or during the drive home. The cameras serve several purposes. They shoot a frame every second or so when no one's home, helping the police in case someone breaks in. They can be switched to real-time action, to keep an eye on the kids, so that you can see if they're cleaning their room. And because the TVs are on the Web, you can see what channels are being watched, in case your 10-year-old is watching Star Trek instead of doing his homework.

TechKnowledgey 2001

Events, Advances, and News From the Electronics World

by Jeff Eckert

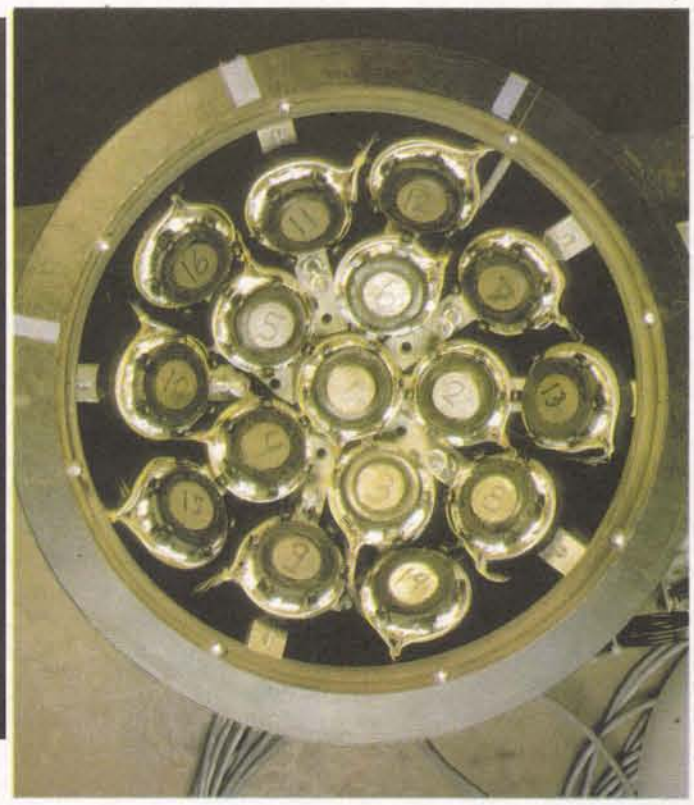
Advanced Technologies

Mini-Robots Suitable for Spy Work

Doug Adkins examines the mini-robots that he and Ed Heller are developing at Sandia National Labs (photo by Randy Montoya).

Researchers at the US Dept. of Energy's Sandia National Laboratories **(www.sandia.gov)** have developed what may be the world's smallest untethered mobile robot. The unit takes up only 1/4 cubic inch and weighs less than an ounce. Powered by three watch batteries, it runs on track wheels. The mechanism consists of an 8k ROM microprocessor, temperature sensor, and two motors that drive the wheels. Future versions may include a miniature video camera, microphone, telecommunications equipment (radio or infrared), or a chemical microsensor. The creators believe that these robots will be useful in many applications, including locating and disabling land mines, and detecting chemical and biological weapons. For example, they could travel through pipes or crawl around buildings looking for chemicals or human activity. Advanced versions could relay information to a remote, manned station and even communicate with each other as they travel in swarms, like insects. The present version, which is agile enough to turn in a space of less than 3/4 inch, has demonstrated its ability to maneuver its way through a field of coins. But if you find yourself being chased by one, don't worry about it catching you. Top speed is only about 20 inches per minute.

Spherical Motor Provides Three-Dimensional Movement



These electromagnets, activated by a computer, attract the permanent magnets and cause the sphere to move into a new position

(photo by Keith Weller).

Engineers at the Johns Hopkins University **(www.jhu.edu)** have built a spherical motor that can rotate in any direction. The device uses computer-controlled electromagnets to achieve position changes. In the prototype, the rotor consists of a hollow sphere in which 80 permanent magnets are mounted. The sphere is contained in a "saddle" of 16 circular electromagnets. By activating two or more of the electromagnets via computer control, the ball is pulled into a new position in any desired direction. The main application envisioned by the inventors — Gregory S. Chirikjian and David Stein — is in robotics, where a more refined version of the motor could replace conventional single-axis motors used for arm movement. Existing robotic arms need six or more motors for three-dimensional positioning and orientation. Only three of the spherical motors would be required to provide more flexible and

accurate movement. Interestingly, it would also be possible to turn the motors upside down, allowing them to function as omnidirectional wheels. In this type of application, it would be possible, for example, to build a computer mouse that moves your hand rather than the opposite. Chirikjian and Stern, along with collaborator Edward Scheinerman, have applied for two patents that cover components used in the device.

Computers and Networking

Wireless Network Becomes Reality at Georgia Tech

Providing a glimpse of the future of wireless networking, the Georgia Institute of Technology **(www.gatech.edu)** has completed implementation of what it calls the Local Area Wireless/Walkup Network (LAWN), which supports both wired connections through walk-up ports and wireless connections through wireless access points in 14 campus buildings. These include classrooms, research facilities, the campus library and bookstore, and various offices. The result is a single local area network that is accessible to all wireless users.

The Georgia Tech LAWN is based on the IEEE 802.11 networking standard, which is also the basis of several commercial wireless networking products such as Apple Computer's Airport. It differs from the newer Bluetooth standard in many respects. For example, 802.11 is faster (5.5 to 11 Mbps theoretical, 4 to 5 Mbps in practice, versus 1 Mbps theoretical, 400 kbps in practice). It also has greater power (1 W in the USA and 100 mW in Europe versus 1 mW) and range (15 to 150 M indoors and 300 M outdoors versus 10 M). However, they both operate in the 2.4 GHz unregulated frequency band, which provides spectacular opportunities for interference when Bluetooth and 802.11 devices are operated in close proximity. For a detailed discussion of Bluetooth versus 802.11, you can download an Acrobat™ pdf file by logging onto webbooks.net/downloads/download.html. For a discussion of interference issues, visit **www.wireless-nets.com/whitepaper_interference.htm**.

Are You Ready for a Networked Kitchen?

How many times have you walked up to the refrigerator, looked at the door, and said to yourself, "I sure wish this thing was connected to the Internet?" Never? Well, then, the US appliance industry is way ahead of you. Later this year, Whirlpool Corporation will introduce a refrigerator with a Web pad attached to the door, and Maytag is working on similar innovations. As 2001 progresses, you may expect to see connectivity added to a range of home appliances, including not only refrigerators, but microwave ovens, washers and dryers, dishwashers, and more.

This may not be as silly as it sounds. For example, it might be nice to have an oven/refrigerator combination that keeps a chicken cold until you send it an email from the office and tell it to start roasting your dinner. And you might like to have a washing machine that can email you (or the repair shop) a warning that its motor is failing. Or how about a refrigerator that scans the bar code as you remove a product and automatically adds the item to next week's shopping list? The possibilities are endless. But is there a market for this stuff? Only time will tell.

Circuits and Devices

Best Processor Awards for 2000

MicroDesign Resources (MDR) has presented its 2001 Analyst's Choice Awards in several categories. The award for the best PC processor was presented to AMD for the Athlon chip, which was the first processor to break the 1 GHz barrier. This is something of a victory over rival Intel, whose 1.13 GHz Pentium III was introduced a mere two days after the Athlon but was recalled a month later. MDR even rated the Athlon over the 1.5 GHz Pentium 4, which has received mixed reviews. The Athlon also received *Maximum PC* magazine's CPU of the Year award and *PC World*'s Product of the Year award.

The best server/workstation processor award went to Sun Microsystems for the Ultra SPARK III processor, which beat several other nominees for first place, including Intel's Itanium, IBM's Freeway for eServer z900, and the Intel Pentium III Xenon devices. The 64-bit UltraSPARC III is based on 29 million transistors and features a 9.6 gigabyte/second address bus, support for an 8 megabyte error checking and correcting external cache, and several other advanced features. The 750 MHz processor has been shipping since last year and is available in the Sun Blade™ 1000 high-end workstations and the Sun Fire™ 280 workgroup servers. For a complete listing of the awards, see www.mdronline.com/awards2000/awardsummary.html.

Industry and the Profession

Power Shortage Dims Silicon Valley Prospects

It appears that the power problems in California are causing many high-tech companies to consider abandoning or at least reducing their presence in California's Silicon Valley. Sun Microsystems (www.sun.com), for example, is looking to its Austin, TX, facilities for growth and plans to have most of its engineering team outside of California by 2003. Sun currently has 150,000 square feet of empty office space in Austin, which would allow it to add more than 500 new employees. In addition, the company has bought 38 acres of commercial land adjacent to its existing facilities. Sun's neighbors in Austin include IBM, Motorola, and AMD, so a major exodus from California could translate into a boom for the electronics industry in Texas.

The recent "rolling blackouts" in California, which cause disruptions in design and fabrication processes, have been a major source of irritation. The Silicon Valley Manufacturing Group (SVMG), a consortium of 190 Silicon Valley employers (including IBM, Agilent, Lockheed-Martin, and National Semiconductor) recently reported that as many as 75 percent of its members have suffered blackouts that lasted 90 minutes to two hours. The blackouts, which often occur with little or no warning, have cost the companies tens of millions of dollars. Some facilities have avoided shutdowns by using backup generators or by maintaining contracts with multiple power providers. But rising energy prices are a separate and probably long-term problem that may take years to solve. Wholesale power prices in California are running $250.00 per megawatt-hour (capped at that level by government regulation), as compared to $100.00 or less in Texas. Power usage presently accounts for as much as 10 percent of the cost of running a chip fabrication operation, and higher prices could significantly drive up chip prices or lower profit margins.

William R. Hewlett Dies

The electronics industry was saddened by the death of William Hewlett on January 12 at the age of 87. Hewlett, who retired from active management of HP in 1978, made important contributions throughout his career in technology, science, and business. Along with David Packard, who died in 1996, he founded Hewlett-Packard Company in a one-car garage in 1939, in Palo Alto, CA, with $538.00 in working capital. The first successful HP product was an audio oscillator, eight of which were used by Walt Disney Studios in the production of the movie "Fantasia." (Previous and unsuccessful products included a foul-line indicator for bowling lanes and an automatic urinal flusher.)

Hewlett believed that one of his greatest accomplishments was the people-oriented approach to management that he developed with Packard. Catastrophic medical coverage, flexible work hours, open offices, decentralized decision-making, management by objective, and employee "coffee talks" are among the policies and practices they instituted at HP. The "HP way" has been adopted by many companies and serves as a legacy of the founders' influence.

Hewlett-Packard now consists of two multinational enterprises: Hewlett-Packard Company, with revenues of $48.8 billion in fiscal year 2000 and more than 88,500 employees, and Agilent Technologies, Inc., with revenues of more than $10.8 billion in fiscal year 2000 and more than 47,000 employees. The legendary garage, widely considered to be the birthplace of the Silicon Valley, is now a California state historical landmark. **NV**

News Bytes

INEXPENSIVE HOLOGRAPHIC STORAGE AND PROCESSORS ARE HERE, FINALLY

After 20 years of research in Holography, ALSET Technologies Group, Inc./HOLO~TESLONIX (Labs) ESOP, is producing the first directly viewable 3-D holograms, with 1,000-to-1 (4000 mil spec) ratio analog linear compression, on a CRT or LCD display medium, which has never been successfully done before until now, according to Co-CEO/CTO R.A. Berman C.C.S.C.

The previously mentioned new-concept holography was based on a 17-year US Patent No. 5055918, PIX-I-E (PIXel - Image - Enhancement) and has been officially launched as a replacement for clock based generated 3-D graphics ray-trace modeling which – with this process – does not require complex ray-trace algorithms to be used to produce the 2-D to 3-D object model modality, used with 3-D video generator cards.

Primitive samples have been generated on the http://holix.airweb.net, HOLO~Images™, in fast load map form. These new types of directly-viewable processed templated holograms replace the need for calculating the light inverse squared equations, normally needed for generating the look-up or clock-rate time based programming methodologies employed in today's gaming and CAD/CAM model industry.

"We utilize a new type of real-time 3-D holographic arrayed HOLO~Portal to generate instantaneous ray-traced imagery, with the extra features of Hyper compression scheme 1,000-to-1 ratio in linear analog wavelet polygonical fractals, which is the normal property of Analog Linear Lateral Holography or ALLH, in our superior modeling Holographic Patented research," states Berman.

"First, the best example of computer game character creation of our corporation's research with said process is Holo-Shadow 1™. No one has been able to produce a non-rotational depth-generated (coherency length) 3-D hologram, directly viewable until now, on an inexpensive medium such as passive (non-TFT active matrix) LCD displays."

"Our new concept HOLO~Images (ALLH) are pretty explanatory visually. If you download our unique type of holography into a paint package (Corel Draw™, etc.), as these holographic graphics are generated normally in bit-map format to produce the best 3-D templated model possible (then converted to jpegs), you will have a template of our special morphing HOLO~ware," Berman continued.

With HOLO~ware, you can easily develop both security and software based on the new HOLO~GUI or HOLOgraphic~Graphics User Interface designed on 3-D Scientific Visualization similar to VR (Virtual Reality), but termed CR or Clone Reality, a much superior methodology to move and process all types of data, using this unique type of search engine, the HOLO~Net Map™.

You now can encrypt secure data with complete assurance that it can not be code broken or altered without your authority, by means of your personal analog coded HOLO~Key™, which will be assigned to the user as a usual "digital signature" key is assigned today.

HOLO~Images may be viewed directly on VGA, S-VGA to XGA, or TV/Composite (S-Video) media, where you may record it to video tape or CD-ROM formats (DVD protocol is not utilized).

"Our new superior, unique 3-D 'Holographic Media' forma, which we refer to as HOLO~Media, will be the replacement for bitmap-dependent, memory-hungry, display cards, flash memory protocol, CD-ROMs, or any other medium that is utilized for volatile or non-volatile data storage" states Berman.

First, to produce this LLH process requires (in the conventional 2-D to 3-D graphics engines) no less than 1,000 or 1K bit-plane maps depth (which the UNIVERSAL HOLO~CODEC™, i.e., UHC, provides), which at this time and 10 years from now, will still not be possible to duplicate (according to Berman), as for the 1,000 bit-plane mapping that would be required.

Second, the innovative 1,000-to-1 ratio linear analog compression scheme they have developed enables any type of digital binary data to be converted without mapping loss to the image, such as j-peging of M-peging causes.

Producing a perfect holographic reproduction is possible without any mathematical (Niquest variable) noise errors, being a result of "resolution fading" as the other primitive digital compression causes in "second generation" production or copy.

Third, when you download the 3-D HOLO~Images (HOLOGRAPHICS), you will be moving a 240 megabyte image file forma, in analog real-time compression forma from the samples on the Hyper-Technics Lab's http://holix.airweb.net official website, which is the "first-of-a-kind" HOLO~Website on the Internet (premiered officially in 2000).

"Our new HOLO~NEO Proc™ processor uses a real-time analog superior conversion process that digital sampling cannot ever achieve, because of its bit-map modality and limitations to clock speed rate generation. This individual hologram consists of 240 megabytes per file, one-quarter of a standard CD-ROM, but with our 1,000-to-1 ratio analog compression scheme, we can generate this humongous digital binary and compress it to about 240 Kbits," explains Berman.

"TESLON~QUANTUM ALPHA is the first truly applied Nanometric storage and processing system that employs a superior Electro~Optical Analog /Digital/Analog (ADA) protocol for data computational errorless processing, instead of the normal prescribed error generated primitive digital data protocol."

"To understand this unique and superior linear analog protocol, you must use a primitive model, such as the "3 BIT OPTO" processor and a "scientific visualization" based on an analog video graphics generator, a "Glyphic" (a single pixel), which represents a collective quantitative quantum information condition (similar to what a Quantum computer utilizes, but ours is based on noiseless analog protocol [analog-to-digital-to-analog or A/D/A] not digital), super positioned as a spectral (colored coherent wavelengths) reference," Berman continues.

"And we use the methodology of mathematical quantalism or dithered sum quatralation, this being the com-

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News Bytes

bined dual coherency which produces a summation mathematically to produce a synthetic or virtual pixel or bit."

In other words, by combining two different colors, say red and green light beams, crossing to produce an intercept, resulting in a mixture of the two colors which will produce a entirely different color, a third color or third virtual bit, the "3 Bit OPTO."

"This is the Nanometric Electro~Optical (NEO) building block, based on our 3-D ALLH that replaces the function of a silicon based transistor in both toggling (switching) and bit-rate microprocessor clocking, but at nanometric atomic size, eliminating the need for silicon wafer manufactured components."

And since it is "blue to UV (430 nm and lower) wavelength" LED coupling technology, the circuits constructed from NEO ALLH material guarantee there is no heat to dissipate, such as silicon wafer's most inherent problem, now solved with NEO circuits.

"And believe it or not, our chips are internally self-powered, with another "quantum gate" breakthrough technology of ours, the "negative entropy" or NE power supply array circuits, a true Star Trek™ breakthrough "transducer" for the 21st century."

"And only we have it, as it is embedded into our HOLO~NEO Proc™ technologies used for both processing and communication power protocol driving both peripherals and interface circuits," Berman concluded.

If you are interested in finding out more or commenting on this holography technology, you can reply by email to the PR/Corporate email: alset@qwest.net or the Technical email: ultr_a@hotmail.com, or phone the office at 480-354-8225 or the Technical Response phone at 281-367-3123.

A tutorial CD-ROM is available to both individuals and USA corporations (no foreign corporations, please apply) for individual CD-ROM $100.00 or USA Corporation CD-ROM $2,500.00 (includes pre-programmed hand-top computer with HOLIX™). You can check out their website at http://www.genaltered.com.

TELECRUZ ANNOUNCES PARTNERSHIP WITH EARTHLINK TO PROVIDE INTERNET ACCESS SERVICE FOR INTERACTIVE TELEVISIONS

TeleCruz Technology Inc., a leading innovator of interactive television platforms, has announced an agreement with EarthLink, the nation's second largest Internet service provider (ISP), to integrate the company's Internet service inside TeleCruz's patented technology platform for Internet access via TeleCruz-enabled interactive television sets.

TeleCruz-enabled televisions featuring EarthLink Internet access will offer consumers easy access to interactive TV services such as email, chat, Internet browsing, and shopping via the convenience of their TVs. The first interactive televisions with EarthLink Internet service are expected to be available from Panasonic in the second half of 2001.

"EarthLink has a worldwide base of 4.7 million subscribers," according to chairman and CEO Kris Narayan. "This agreement opens a new customer channel for EarthLink and allows TeleCruz to bring its message of easy and affordable interactivity to a growing global market."

"The TeleCruz platform offers consumers – including those who may not have a computer – an innovative, affordable, and easy way to access the Internet through their television," said Lance Weatherby, executive vice president of the ISP's "EarthLink Everywhere" initiative. "This new alternative to the personal computer extends our ability to offer our award-winning Internet access to a broad range of consumers."

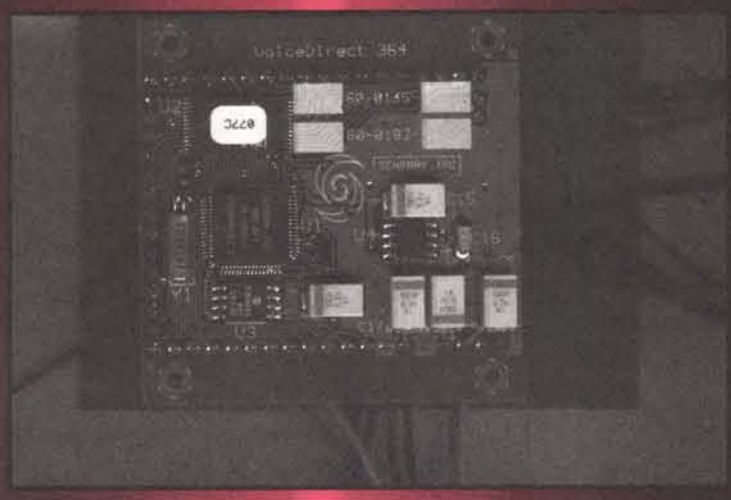
TeleCruz enables a wide variety of interactive television services at a low cost by providing an open, patented technology platform for integration inside the TV. The company's open-platform, system-on-a-chip architecture is capable of supporting interactive capabilities being created by advertisers, content creators, and broadcasters alike. TeleCruz works with TV manufacturers, as well as ISPs and interactive content providers, including AT&T, Yack.com, and Spiderdance, to bring the benefits of interactive television to average TV viewers everywhere.

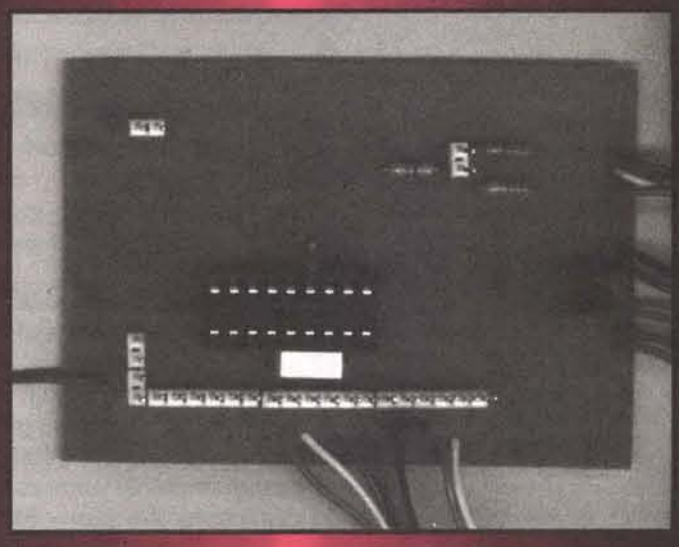
TeleCruz-enabled TV sets allow consumers to connect to the Internet without a computer or set-top box via an embedded modem, chip-set, and interactive software package contained within the TV itself. After logging on for the first time and navigating a quick online sign-up process, new EarthLink subscribers can surf the Web, send email, and enjoy enhanced programming through the simple click of a remote or wireless keyboard. Existing EarthLink subscribers are able to enjoy the device immediately by logging on with their EarthLink username and password at no additional charge to their current Internet service contract. You can visit TeleCruz on the world wide web at

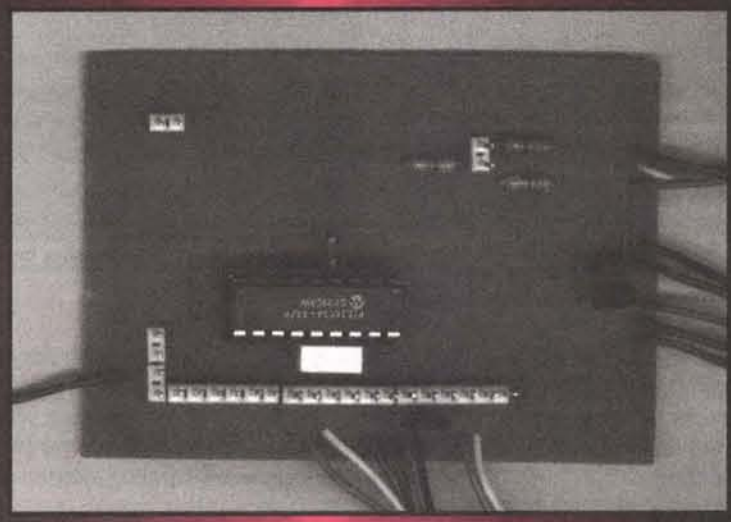
CONTINUED ON PAGE 72

by Dennis Shepard

Build Your Own Voice Recognition Alarm System







We live in an age of rapidly changing technology. This has its good and bad points. For example, most vehicles have an alarm system installed. Many are quite sophisticated and include proximity detectors to check if someone is 'close enough' to be a threat. They'll usually 'talk to you' to let you know this as well. Some of these systems use a 32-bit or higher security code to 'disable' the system before entering or 'enable' the system upon leaving. And it's not very 'foolproof' either.

These key chain transmitters generate a 'signal' which can be picked up by a nearby scanner. That means that the signal can be captured and duplicated and for all intents and purposes, the alarm system is defeated. Or, they might use a digital sequence generator which generates all the security codes in sequence. All someone has to do is run the generator nearby and wait until your system 'beeps' to indicate it's been disarmed!

One of the more interesting ways to take care of this problem is a Voice Recognition (or VR) system to take care of the 'enable' and 'disable' features required of an alarm system. What follows is a universal VR alarm system which recognizes up to three separate voices and provides a full range of options for the most discriminating user.

Desired Features

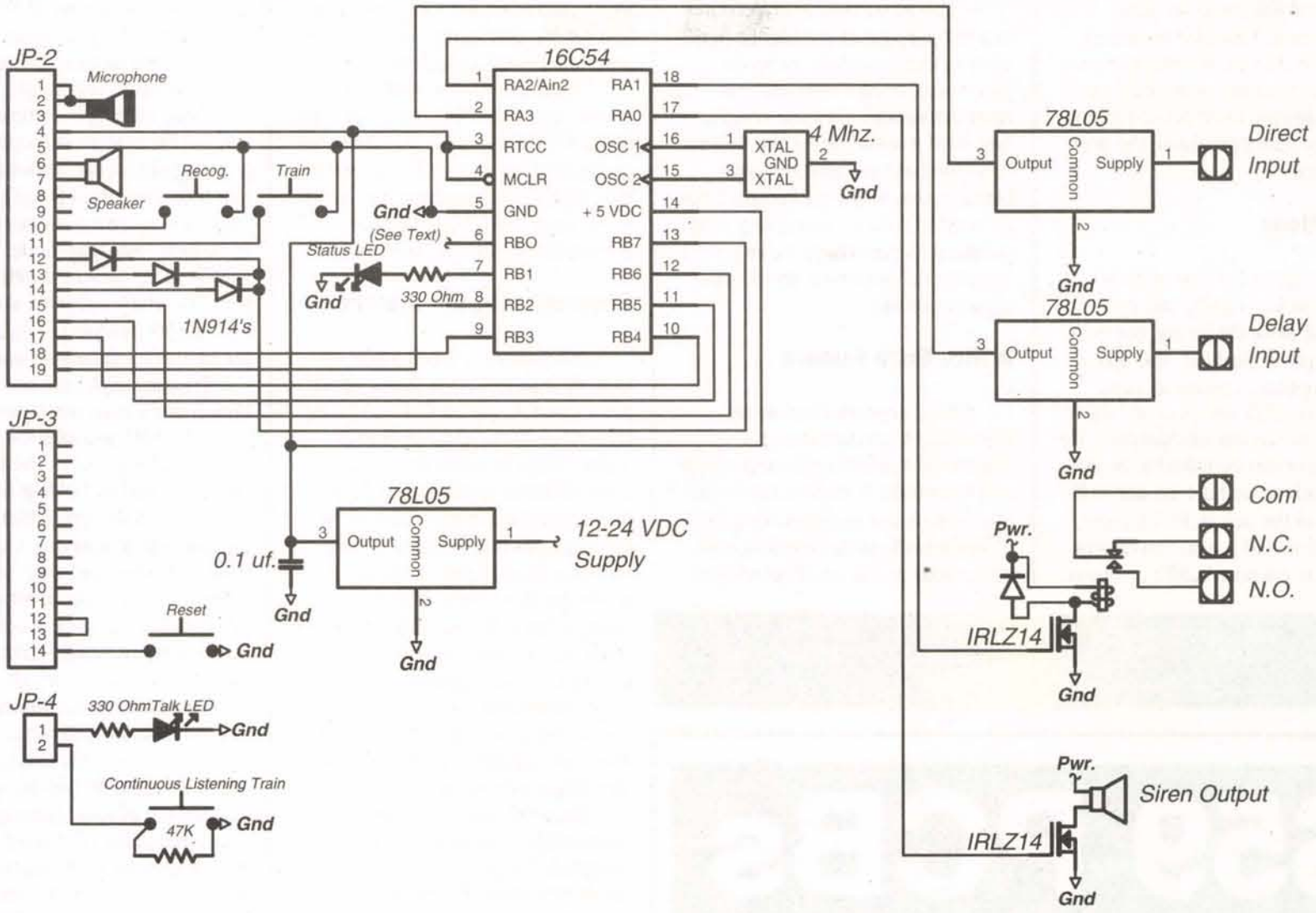
In order to make an alarm system 'universal,' certain features must be present. These include an LED output which indicates the status of the system. Another feature is an output for alarm condition (our system has two), a discrete output which is on until reset, and a digitally-generated audio siren. Depending on the speaker impedance and the power supply voltage, the system can be heard for blocks! We'll cover this more in detail with the actual circuit description.

Now for inputs ... we have two options available: an immediate alarm contact and a 30-second time-delayed contact. The latter allows you to enter a 'protected' area to 'disable' the system without an alarm. As you can see, this simple – but effective – arrangement has lots of different applications in many situations. We think you'll find it's just what you are looking for.

Circuit Description

The VR Security System is based on a Sensory VD364 continuous

Continuous Listening Voice Recognition Alarm System



listening mode VR module which has been configured for a three-gateway word mode of operation. Each channel has five output commands available, which will be discussed in detail later in the article. Sensory's website at http://www.sensoryinc.com contains all the documentation, so we won't repeat it here.

The VR module is interfaced to a PIC 16C54 microcontroller chip which has 12 I/O lines. Six lines are used for interfacing and the other six lines take care of the system input and output options. The 1N914 'steering' diodes allow three different individuals to operate the system – even in three different languages, if you like! The HEXFET transistors are used for high-current switching of the output options. If these options aren't required, simply eliminate the transistor for that option.

We live in an age of rapidly changing technology. This has its good and bad points.

The digitally-generated siren output is fed to an ultra-low (0.2 ohm) HEXFET switching transistor which is rated at 60 VDC and 40 amps in the pulsed mode of operation. By using Watts law and not exceeding a low resistance value of 2 ohms, you can generate up to 1,800 watts of peak power! Don't forget a massive fan-cooled heatsink at this power rating, however. The rest of the system is relatively straightforward. We'll cover it in more detail in the set-up procedure.

Voice Commands

Here's where it gets real interesting. We'll break the commands down in generic terms and then discuss each one's function in detail. They are in order:

Command #	Function
1	Arm The System
2	Disarm The System
3	Silent Alarm Mode
4	RB0 = High
5	RB0 = Low

Arming the system allows each of the inputs to control both outputs according to the following logic. The direct input must be high to enable the system before the PIC will respond to the VR module output. Please note that the VR module will 'initiate' the commands with the delay input low. Obviously, this feature lets you enable the system within a protected area (your car, for example), and then leave and secure the area (delay input becomes high) before the 30 seconds times out.

Normal Mode

If we select Command 1, the LED will be on continuously for 30 seconds and then the LED will flash on and off at a 1-Hz rate. This 30-second interval is the 'arming' mode of operation. A low input on the direct input during this time will immediately cause the system to go into alarm. Once an alarm has occurred, the siren will cycle on and off for 30-second intervals. The relay output will be on continuously, though.

A low input on the delay input will cause the LED to extinguish immediately. You have entered the 'tripped' mode of operation and now have 30 seconds to enter the pro-

tected area and disable the system using (Command 2). If you don't, then the outputs will go into 'alarm' mode as mentioned above. A direct input going low at any time during this interval will cause an 'alarm' mode, as well. Basically, the direct input is used to control the system from outside of the protected area and the delayed input is used to control the system from within the protected area.

Silent Mode

If we select Command 3, the LED will 'flicker' rapidly and the inputs will work identically, but the siren output is disabled. This gives you the option to produce 'silent' alarms. The LED will show an 'alarm' mode by remaining extinguished. The relay output can be linked to an autodialer (such as we have on our website) to call the police, for example. Using Command 2, you can disarm the system anytime before an alarm occurs. The LED will be extinguished in this mode.

Resetting the System

It should be easy to understand that the purpose of the silence period is to let the system recognize your voice, using Command 2 to reset the system. Can you imagine how hard it would be for the system to understand you with the siren blasting away in the background! Yes, we tried to think of everything. And speaking of everything, we've got an undedicated output for you to use anyway you like.

A Nice Extra Feature

RB0 is controlled solely by Command 4 and Command 5. Command 4 enables the output high and Command 5 enables the output low. This output operates completely independently of the alarm system commands. It has no effect whatsoever on the LED, either. Let's say, for example, you use it to control a relay which interrupts the wiring to the starter on your car. That way, you can disable the starter, enable the alarm, and leave the car. Then, when you return, you can disable the alarm and then enable the starter.

I think it would be pretty hard for anyone to bypass this nor would they waste their time trying. The alarm will probably scare them off long before they figure out something else needs to be done. And that, of course, is the whole idea of any alarm system!

Programming the System

The module is wired a little differently than the Voice Recognition X-10 Control System featured in the December 2000 issue of *Nuts & Volts.* This is because we're using three different 'gateway' words with five commands apiece. Each of the five commands is identical in function even though you could use different words or even different languages! Basically, the 'gateway' word could be as simple as your name, for example. Or, as sophisticated as any 2-1/2 second phrase of your choosing! By the way, this 2-1/2 second interval is available for all 'gateway' and command words.

Once the unit is assembled, we're ready to set it up for proper operation. On power up, the speaker will beep once to let you know the VoiceDirect module is okay. The talk LED will flash but extinguish if no training has occurred. Pressing the CL train (continuous listening mode) button will prompt you to say "word 1" and repeat it a second time. It will also tell you if it got it right, or if it didn't, and even why it didn't! Once you have trained your 'gateway' word, you're ready to train each of the five commands per 'gateway' word.

Each individual command is set up using the train (non-CL) button. It needs to be pressed for each word because the system doesn't know beforehand how many commands it will be responding to. And it has to be completed for each of the three 'gateway' words in sequence. It will prompt you to say 'word 1-1.' This will continue through 'word 1-5.' Then it's time to train the second 'gateway' word, and so on.

Once training is complete, you can put the system into operation by pressing the recognize button. At that time, the talk LED will light indicating the system has entered the continuous listening mode. This LED is NOT to be confused with the status LED, which indicates alarm status. The VR module LED is an indicator for voice recognition only.

Pressing either the recognize button or CL train button will extinguish the LED and take the system out of listening mode. The system can be erased by holding down both the train and recognize buttons together for at least one second. The system will respond with "memory erased." There's lots of other prompts like "spoke too soon," "similar to previous word," "please talk louder." Once again, it's all covered in the documentation which is available on Sensory's website.

In operation, the talk LED is lit and will flash to let you know it's recognized the proper 'gateway' word. If it recognizes the next word as well, the appropriate command is sent. It will also tell you which command number was sent. If not, the unit has to recognize the 'gateway' word again before it will recognize another command.

We haven't gone into every detail in construction and use on purpose. That's entirely up to you. Please note that we didn't include a layout on the PCB for the relays or HEXFET transistors.

That was done deliberately to give you the greatest amount of flexibility, depending on what options you want to use. That pretty well sums it up. Enjoy ... **NV**

Three different kits are available from Shepard Engineering Concepts. The first one consists of the preprogrammed PIC, ceramic resonator, and 78L05 voltage regulator for $20.00 delivered anywhere in the continental US. The second kit includes the VoiceDirect 364 module ONLY for $55.00. The third kit contains the VoiceDirect 364 Module and all components included above for $70.00 including shipping and handling anywhere in the Continental US. California residents add 7.50% state sales tax. Payment methods preferred are money orders, certified checks, or Western Union. **Please make payments payable to: Dennis Shepard.**

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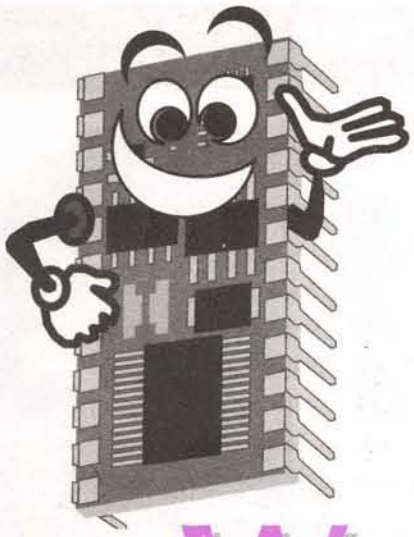


by Jon Williams

Stamp Applications

Conversion Considerations

Putting the Spotlight on BASIC Stamp Projects, Hints, and Tips

What we're going to do this month is demonstrate the differences and create portable code that's easy to update when we want to upgrade to a faster Stamp.

BS2 Family Review

Module	I/O Pins(1)	Programs	Scratch RAM(2)	Speed(3)	Current @ 5V
BS2	16 + 2	1 x 2K	N/A	1	8 mA
BS2sx	16 + 2	8 x 2K	63 bytes + 1	2.5	60 mA
BS2e	16 + 2	8 x 2K	63 bytes + 1	1	20 mA
BS2p-24	16 + 2	8 x 2K	127 bytes + 5	3	40 mA
BS2p-40	32 + 2	8 x 2K	127 bytes + 5	3	40 mA

Notes:

1. Each Stamp has two dedicated serial I/O pins. These pins are used for programming and can be used (as pin 16) with **SERIN** and **SEROUT**.

2. The BS2p scratchpad RAM locations 127 through 131 are read-only.

3. Speed is shown relative to the BS2.

More Power Means More Current

You can see by the chart that all of the multi-program Stamps consume more current than the stock BS2. This is due to the change from a Microchip PIC to the Ubicom SX micro (a change necessitated by the desire for more program and variable space). The BS2sx was the first multi-program Stamp. The BS2sx runs a full two-and-a-half times faster than the BS2, but at a significantly higher current. This is something to think about when using battery power for your applications.

With five — yes, that's right, five — members of the BS2 family in circulation, it's very likely that we're going to start moving code from one to another; usually from a stock BS2 to one of the new units (BS2sx, BS2e, or BS2p). The new Stamp manual from Parallax does a great job explaining the speed differences between the various commands.

Parallax responded to customer requests for a multi-program, lower-current Stamp with the BS2e. The BS2e uses the same micro as the BS2sx, but at a lower speed. The result is a multi-program Stamp that runs at the same speed as the stock BS2, and has the eight program slots of the BS2sx. This makes the BS2e a nice choice for updating when you run out of program space since there are no syntax changes required for the code to run properly.

More Memory

The BS2sx, BS2e, and BS2p have multiple program slots which means, in theory, that we should be able to write longer programs. Right? Well, yes and no. The new Stamps actually have separate banks of program space and a common area called the scratchpad RAM. So what do we do?

The idea is easy: We simply put subroutines or little-used code in one of the other program banks and call it when we need it. There's the rub. You see, we can't do a **GOTO** or **GOSUB** across program banks and, unless specific precautions are taken, our variables will get mangled when switching from one bank to another.

When using multiple program banks, I take advantage of the **BRANCH** function and design my main and secondary programs with a task-switcher approach. I generally prefer this design style since it eliminates a lot of **IF** *statement* **THEN** *addr* statements in the code. If conditions change that require a different code block to execute, the current task simply changes the task pointer variable. On the next pass through the switcher, the appropriate code will be run. This design is also helpful when using secondary program slots to store subroutines and other code.

For review, here's a simple task-switcher framework that will work with any Stamp:

```
' -----[ Title ]-------------------------------------------------
'
' File..... TASKER.BS2
' Purpose... Task switcher framework
' Author.... Jon Williams
' E-mail.... jonwms@aol.com

' -----[ Program Description ]-------------------------------
'
' General purpose task-switcher for Stamp programs.

' -----[ Constants ]-----------------------------------------
'
NumTasks CON     2                          ' number of tasks

' -----[ Variables ]-----------------------------------------
'
task             VAR     Byte               ' current task

' -----[ Initialization ]------------------------------------
'
Initialize:
 task = 0                                   ' define first task

' -----[ Main Code ]-----------------------------------------'
Main:
 BRANCH task,[Task0,Task1]                  ' run current task block
NextTask:
 task = task + 1 // NumTasks                ' point to next task
 GOTO Main                                  ' back to top

' -----[ Subroutines ]---------------------------------------
'
Task0:
 ' task code here
 GOTO NextTask

Task1:
 ' task code here
 GOTO NextTask
```

The point of this design is that the task variable keeps track of where we are in the program. We'll use this to our advantage when switching to another program slot. The current task gets saved so that when we come back, we know where to start running.

The multi-program BS2sx introduced three new keywords to PBASIC:

- **PUT** *location,byte_data*
- **GET** *location,byte_data*
- **RUN program_slot**

PUT and **GET** work like **WRITE** and **READ** except that the data is written to or read from the Stamp's scratchpad RAM area. The BS2sx and BS2e each have 63 bytes (addressed as 0 to 62) of user

Conversion Considerations

RAM; the BS2p has 127. The scratchpad RAM is common to all programs, so it's easy to use as a means of exchanging data between programs.

What about our main program variables? Well, if we're not careful, they can be clobbered by our secondary program. Is there a way to prevent this? Yes, there is. The trick is to copy our variable definitions from the main program to the secondary program. When the **RUN** function is executed, the variable space is not cleared as it is on a reset. If our definitions are the same in both our main and secondary programs, we can happily switch between the two without worry about the variables. Of course, there will be those programs where this isn't possible. In those cases, we can **PUT** variables that we need to save into the scratchpad and then **GET** them in the secondary program or when we return. If the secondary program requires its own local variables, simply place them after the shared definitions.

Let's put our little task switcher to work in a simple program that demonstrates these concepts. Be sure to change your $Stamp definition to BS2sx or BS2p if you're not running a BS2e.

```
' -----[ Title ]-------------------------------------------------------------
'
' File..... TASKER2.BSE
' Purpose... Task switcher demonstration with external subroutines
' Author.... Jon Williams
' E-mail.... jonwms@aol.com

' {$STAMP BS2e, SUBS.BSE}                  ' or BS2sx or BS2p

' -----[ Program Description ]-----------------------------------------------
'
' Simple task switcher demonstration with external subroutines
' (in SUBS.BSE)

' -----[ Constants ]---------------------------------------------------------
'
NumTasks CON     3                        ' number of tasks
SubNum   CON     0                        ' RAM location of external

' -----[ Variables ]---------------------------------------------------------
'
task             VAR     Byte             ' current task
count1           VAR     Byte             ' byte counter
count2           VAR     Word             ' word counter

' -----[ Main Code ]---------------------------------------------------------
'
Main:
 task = task + 1 // NumTasks              ' point to next task
RunTask:
 BRANCH task,[Task0,Task1]                ' run current task block
 GOTO Main                                ' back to top

' -----[ Subroutines ]-------------------------------------------------------
'
Task0:
 PUT SubNum,0                             ' define external subroutine
 RUN 1                                    ' run subs program

Task1:
 count2 = count2 + 10                     ' local update
 PUT SubNum,1                             ' define external subroutine
 RUN 1                                    ' run subs program

Task2:
 DEBUG "(TASKER [2])",TAB,DEC count2,CR
 PAUSE 500
 GOTO NextTask
```

Notice that the first thing the program does is update the task variable. This is necessary since we'll be returning from an external program and need to update the task. This could be done externally, but I generally choose not to. Keep in mind that on reset, Task1 will be the first section of code that runs.

Okay, now for our subroutines program. Again, we must define any local variables after our shared definitions – this will keep our main program variables intact.

```
' -----[ Title ]-------------------------------------------------------------
'
' File..... SUBS.BSE
' Purpose... External subroutines for BASIC Stamp program
' Author.... Jon Williams
' E-mail.... jonwms@aol.com

' {$STAMP BS2e}                            ' or BS2sx or BS2p

' -----[ Program Description ]-----------------------------------------------
'
' Subroutines for TASKER.BSE

' -----[ Constants ]---------------------------------------------------------
'
SubNum           CON     0               ' RAM location of subroutine

' -----[ Variables ]---------------------------------------------------------
'
' (shared)
task             VAR     Byte            ' current task
count1           VAR     Byte            ' byte counter
count2           VAR     Word            ' word counter

' (local)
sub              VAR     Byte            ' subroutine to run

' -----[ Main Code ]---------------------------------------------------------
'
Main:
 GET SubNum,sub                          ' read sub to run from RAM
 BRANCH sub,[Sub0,Sub1]                  ' run the subroutine
 RUN 0                                   ' return if bad sub number

' -----[ Subroutines ]-------------------------------------------------------
'
Sub0:
 DEBUG "(SUBS [0])",TAB,DEC count1,CR    ' show count1
 count1 = count1 + 1                     ' external update of variable
 PAUSE 100
 RUN 0                                   ' return to main program

Sub1:
 DEBUG "(SUBS [1])",TAB,DEC count2,CR    ' show count2
 PAUSE 100
 RUN 0                                   ' return to main program
```

Using this approach, you can extend your programming space and keep things organized. Just remember that if you have to pass word-sized variables via the scratchpad, two **PUT** and **GET** functions are required as **PUT** and **GET** work only with bytes.

Speedy Updates

In addition to the added program space, the BS2sx and BS2p give us extra speed. This is great, especially when we're trying to get quite a bit done in a short period of time. What this means for us, however, is that we'll have to make changes in our code to accommodate the higher speed

Conversion Considerations

of the new Stamps. Unfortunately, it's not a simple matter of factoring by 2.5 (BS2sx) or 3 (BS2p). For specifics, you need to consult the new (Version 2.0) Stamp manual. The new manual does a great job of detailing the speed differences for each function and it's available for download at no charge from Parallax.

The following functions will require updating when moving from the BS2 or BS2e to the BS2sx or BS2p:

- **COUNT**
- **PULSIN**
- **PULSOUT**
- **PWM**
- **DTMFOUT**
- **FREQOUT**
- **RCTIME**
- **SERIN**
- **SEROUT**

Let's take a look at one of these functions and what we can do to plan for changes with a faster Stamp. The following program reads the frequency from a simple pulse generator (Figure 1).

```
' -----[ Title ]-------------------------------------------------------
'
' File..... SHOWFREQ.BS2
' Purpose... Displays input frequency
' Author.... Jon Williams
' E-mail.... jonwms@aol.com

' {$STAMP BS2}                          ' or BS2e, BS2sx or BS2p

' -----[ Program Description ]-----------------------------------------
'
' This program reads an incoming square wave with PULSIN and displays the
' frequency in Hertz.

' -----[ I/O Definitions ]----------------------------------------------
'
F_pin           CON     0               ' frequency input pin

' -----[ Constants ]---------------------------------------------------
'
FreqCon CON     $0200                   ' conversion for BS2/BS2e
'FreqCon CON    $00CC                   ' conversion for BS2sx (0.80)
'FreqCon CON    $00BF                   ' conversion for BS2p (0.75)

' -----[ Variables ]---------------------------------------------------
'
pHigh           VAR     Word            ' high pulse width
pLow            VAR     Word            ' low pulse width
period          VAR     Word            ' cycle time (high + low)
freq            VAR     Word            ' frequency

' ---------------------------------------------------------------------

Main:
 PULSIN F_pin,0,pHigh                   ' get high portion of input
 PULSIN F_pin,1,pLow                    ' get low portion of input
 period = (pHigh + pLow) */ FreqCon     ' calculate cycle width
 freq = 50000 / period * 20             ' calculate frequency

 ' display on DEBUG screen

 DEBUG Home
 DEBUG "Period..... ", DEC period, " uS   ", CR
 DEBUG "Frequency... ", DEC freq, " Hz   "

 GOTO Main                              ' do it again
 END
```

I'm a big fan of using CONstants in my programs. I think it makes them easier to read and I know for a fact that it makes code easier to update. This program shows how we can use a constant for the frequency conversion (FreqCon) value in anticipation of an update to a faster Stamp.

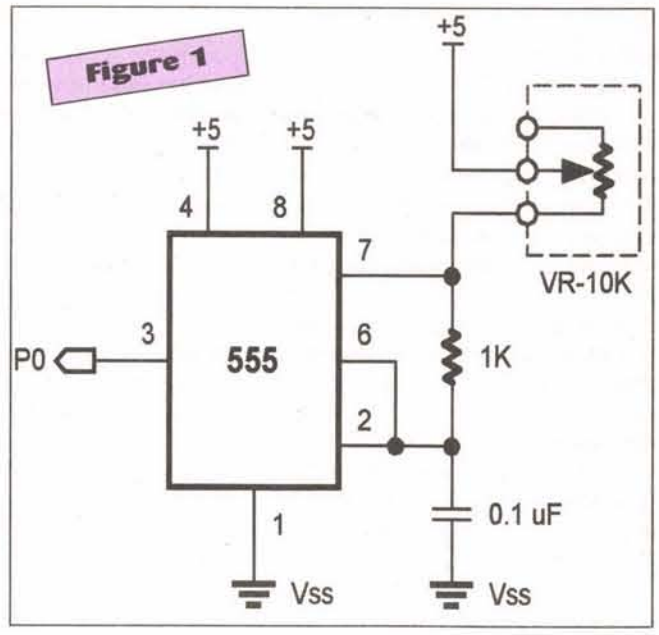
We need to use a different value for each Stamp type because of the unit's value returned by **PULSIN**. Here's the breakdown:

· BS2/BS2e	2 us
· BS2sx	0.8 us
· BS2p	0.75 us

At first blush, you may get concerned over the unit's change from a whole number (2) to a fractional value. Thankfully, the */ (star slash) operator lets us multiply fractional values. If the low-order byte of our star slash value is zero, we're simply multiplying by the whole number in the high-order byte.

It would be nice if all conversions were this easy, but the truth is that they aren't. That said, a little bit of planning will go a long way to simplifying your code conversions. PBASIC is surprisingly resilient and, in most cases, will support your update requirements without a lot of stress.

New Commands In the BS2p



There are new commands in the BS2p that will be of interest to current Stamp users, specifically the LCD commands, I2C commands, and scanning inputs for changes.

Stamp users have been connecting standard parallel LCDs to Stamps since the days of the BS1.

When porting your BS2 apps to the BS2p, you'll need to note the connection requirements dictated by the BS2p. Here are the options:

LCD	Option 1	Option 2
LCD.E	BS2p.0 or BS2p.1	BS2p.8 or BS2p.9
LCD.R/W	BS2p.2	BS2p.10
LCD.RS	BS2p.3	BS2p.11
LCD.DB4	BS2p.4	BS2p.12
LCD.DB5	BS2p.5	BS2p.13
LCD.DB6	BS2p.6	BS2p.14
LCD.DB7	BS2p.7	BS2p.15

Any change required is well worth the trouble as the **LCDOUT** command is a joy to work with — all of the nice modifiers of **SEROUT** work with **LCDOUT**. Here's a neat little routine to right justify a number in the LCD:

```
RJ_Print:                               ' right justify
 digits = width
 LOOKDOWN temp,<[0,10,100,1000,65535],digits
 LCDOUT LCDpin,pos,[REP " "\(width-digits),DEC temp]
 RETURN
```

The routine prints the variable temp on the LCD at the location specified by pos. The width of the field is specified by the variable width. This routine works so nicely because we're able to use the REP and DEC modifiers with **LCDOUT**.

Many Stamp programmers have successfully connected I2C parts to the BS2, BS2sx, and BS2e. This is possible due to the synchronous nature of the Philips I2C buss. The only drawback is the manual code required to do it.

If connecting I2C parts to your Stamp projects, the BS2p will be a real time and code save. You only need to be mindful of the BS2p connection requirements imposed for I2C parts. Here are your options:

I2C Bus	Option 1	Option 2
SDA	BSP.0	BSP.8
SCL	BSP.1	BSP.9

Once again, any changes necessitated by these connection requirements will be well worth the effort. Like **SERIN** and **SEROUT**, **I2CIN** and I2COUT are very easy to use and work with the new SPSTR serial modifier. With SPSTR, you can buffer a large block of data from an I2C device to the scratchpad RAM area.

Another reason to consider the BS2p is if your current Stamp program is constantly scanning inputs for a change. By using the latching option of **POLLMODE** (mode value + 8), your inputs will be saved until the code has time to check them (and you can eliminate external latching hardware if you've been using it). By implementing the task-switcher design we discussed earlier, a task can be defined to check polled inputs by reading the interrupt pin states from scratchpad locations 128 through 131. The next

Conversion Considerations

task or any other action can be determined by the state of the inputs. Be sure to re-issue **POLLMODE** to clear inputs before the next scan.

Finally, adding Dallas 1-Wire devices to anything other than the BS2p requires external hardware. If you're interested in using 1-Wire technology, the BS2p is the only way to go.

Times Change

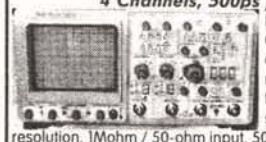
Products change. Luckily for us consumers, most product changes bring improvements and that is clearly the case with Parallax's BS2 series of controllers. One can only wonder what cool things are coming next. Whatever it is, I'm sure it will be worth the wait. Happy Stamping. **NV**

```
' -----[ Title ]-----------------------------------------------------------
'
' File..... SUBS.BSE
' Purpose... External subroutines for BASIC Stamp program
' Author.... Jon Williams
' E-mail.... jonwms@aol.com

' {$STAMP BS2e}                          ' or BS2sx or BS2p


' -----[ Program Description ]---------------------------------------------
'
' Subroutines for TASKER.BSE


' -----[ Constants ]-------------------------------------------------------
'
SubNum          CON     0               ' RAM location of subroutine


' -----[ Variables ]-------------------------------------------------------
'
' (shared)
task            VAR     Byte            ' current task
count1          VAR     Byte            ' byte counter
count2          VAR     Word            ' word counter

' (local)
sub             VAR     Byte            ' subroutine to run


' -----[ Main Code ]-------------------------------------------------------
'
Main:
  GET SubNum,sub                        ' read sub to run from RAM
  BRANCH sub,[Sub0,Sub1]                ' run the subroutine
  RUN 0                                 ' return if bad sub number


' -----[ Subroutines ]-----------------------------------------------------
'
Sub0:
  DEBUG "(SUBS [0])",TAB,DEC count1,CR  ' show count1
  count1 = count1 + 1                   ' external update of variable
  PAUSE 100
  RUN 0                                 ' return to main program

Sub1:
  DEBUG "(SUBS [1])",TAB,DEC count2,CR  ' show count2
  PAUSE 100
  RUN 0                                 ' return to main program
```

```
' -----[ Title ]-----------------------------------------------------------
'
' File..... TASKER2.BSE
' Purpose... Task switcher demonstration with external subroutines
' Author.... Jon Williams
' E-mail.... jonwms@aol.com

' {$STAMP BS2e, SUBS.BSE}                ' or BS2sx or BS2p


' -----[ Program Description ]---------------------------------------------
'
' Simple task switcher demonstration with external subroutines
' (in SUBS.BSE)

' -----[ I/O Definitions ]-------------------------------------------------
'


' -----[ Constants ]-------------------------------------------------------
'
NumTasks CON    3                       ' number of tasks
SubNum          CON     0               ' RAM location of external


' -----[ Variables ]-------------------------------------------------------
'
task            VAR     Byte            ' current task
count1          VAR     Byte            ' byte counter
count2          VAR     Word            ' word counter

' -----[ EEPROM Data ]-----------------------------------------------------
'

' -----[ Initialization ]--------------------------------------------------
'

' -----[ Main Code ]-------------------------------------------------------
'
Main:
  task = task + 1 // NumTasks           ' point to next task
RunTask:
  BRANCH task,[Task0,Task1]             ' run current task block
  GOTO Main                             ' back to top


' -----[ Subroutines ]-----------------------------------------------------
'
Task0:
  PUT SubNum,0                          ' define external subroutine
  RUN 1                                 ' run subs program

Task1:
  count2 = count2 + 10                  ' local update
  PUT SubNum,1                          ' define external subroutine
  RUN 1                                 ' run subs program

Task2:
  DEBUG "(TASKER [2])",TAB,DEC count2,CR
  PAUSE 500
  GOTO NextTask
```

```
' -----[ Title ]-----------------------------------------------------------
'
' File..... SHOWFREQ.BS2
' Purpose... Displays input frequency
' Author.... Jon Williams
' E-mail.... jonwms@aol.com

' {$STAMP BS2}                           ' or BS2e, BS2sx or BS2p


' -----[ Program Description ]---------------------------------------------
'
' This program reads an incoming square wave with PULSIN and displays the
' frequency in Hertz.


' -----[ I/O Definitions ]-------------------------------------------------
'
F_pin           CON     0               ' frequency input pin


' -----[ Constants ]-------------------------------------------------------
'
FreqCon CON     $0200                   ' conversion for BS2/BS2e (2.00)
'FreqCon CON    $00CC                   ' conversion for BS2sx    (0.80)
'FreqCon CON    $00BF                   ' conversion for BS2p     (0.75)


' -----[ Variables ]-------------------------------------------------------
'
pHigh           VAR     Word            ' high pulse width
pLow            VAR     Word            ' low pulse width
period  VAR     Word                    ' cycle time (high + low)
freq            VAR     Word            ' frequency

' -------------------------------------------------------------------------

Main:
  PULSIN F_pin,0,pHigh                  ' get high portion of input
  PULSIN F_pin,1,pLow                   ' get low portion of input
  period = (pHigh + pLow) */ FreqCon    ' calculate cycle width
  freq = 50000 / period * 20            ' calculate frequency

  ' display on DEBUG screen

  DEBUG Home
  DEBUG "Period..... ", DEC period, " uS    ", CR
  DEBUG "Frequency... ", DEC freq, " Hz    "

  GOTO Main                             ' do it again
  END
```

350MHz, TEKTRONIX 2467, MICRO CHANNEL PLATE CRT! 4 Channels, 500ps per div. in normal room light.



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@VIN	INL	RPM	R/A RPM
6V	18mA	177	24
9V	21mA	257	37
12V	24mA	381	50

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TYPE 133SA.....$25ea.

SUPER, MINI C-MOUNT CAMERAS, Super sensitive, GM410 or the general purpose GM412,

The GM-412 specs: B&W, size 1.5"sq. X 2.4"L, 250,000 Pixels, 380 Lines Resolution, Sensitivity 0.3 Lux, The GM410 specs: size only 1.5" SQ. x 1.6"L, >270,000 Pixels, 410 Lines Res., Sens. 0.05 LUX., Both cameras are 1/3" CCD with AGC & Electronic shutter. 12V @110mA power. NTSC out. IR SENSITIVE, BNC video out, Both use std. DC pwr. jack. Aluminum housings with dual threaded top and bottom mounting. True performance not hype! These cameras will outperform *ANY* camera in this magazine. Multi-lens options are available to exploit their superior performance.GM412 shown bottom. GM410 shown top.

GM412, less lens..$99,
GM410, less lens..$149

C-MOUNT LENSES

LOW LIGHT	STANDARD
16mm, f1.6, 15° FOV $39	4mm, 80° FOV $24
8mm, f1.3, 40° FOV $49	8mm, 40° FOV $24
4mm, f1.4, 78° FOV $49	12mm, 28° FOV $24

NEW and IMPROVED, 0.003Lux,UNDERWATER B&W CAMERA, NOW 16X MORE SENSITIVE. and now with 12 INTERNAL, INFRA-RED LEDs!

Sleek black anodized, BRASS, housing. O-Ring sealed & WATERPROOF down to 60feet. Adjustabe mount included. Specs: 1/3" CCD, 400 Lines res.,super 0.003 Lux sensitivity, AGC, Auto Shutter. 12VDC @200mA, 4mm, 78° FOV lens, A real glass lens. NTSC video out. Superior construction. SENSITIVE to IR. Ultra small Size only: 1.25"diam. X 2" long. With 60 ft. cable. Perfect as a remote area, pipe or ductwork inspection camera. Excellent for general outdoor use as well. **GM-300KX-12.....$179**

NEW and IMPROVED, COLOR (down to 60 ft.) UNDERWATER. now with 12, Built-in WHITE LIGHT LED'S,

Sleek black anodized, BRASS, housing. O-Ring sealed & WATERPROOF. Adjustabe mount incl. Specs: 1/4" CCD, 350 Lines res., 0.5 Lux sensitivity, AGC, Auto Shutter. 12VDC @200mA, 4mm, 78° FOV lens, A real glass lens. NTSC video out. Superior construction. Ultra small Size only: 1.25"diam. X 2" long. With 60 ft. cable. Perfect as a remote area inspection camera. Now with TWELVE, super bright, white LED'S! BRAND NEW, **GM-400K-12LED.....$229ea.**

ULTRA RESOLUTION & HIGH SENSITIVITY, SCIENTIFIC QUALITY CAMERA for demanding applications.

Type GM-6000, offers 410K pixels, 570 Lines resolution, < 0.1 LUX sensitivity. >45db s/N with AGC off. Access to all operating parameters from outside the camera! C or CS mount. Adjustable shutter speed from 1/60 to 1/ 100000sec, BLC on/off with adjustable area weighting, AGC on/off, gain, auto/off., Auto iris selectable, DC/ Video with level control, external/internal sync. 24VAC powered, adapter included. Video out on BNC. Industrial quality metal housing.Just the thing for scientific or low light. **SPECIAL, GM6000.....$199ea.**

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First, we have a Jennings , CLFI-50-0030, (shown left), vacuum capacitor, rated at 50pf ± 10% @ 30KV, Size: 2.2" Diam. x 6.5"L, if that's to much for you, we have the CD, type 4CM #10-26620-01 Aluminum electrolytic, rated at 560uF @ 400VDC, Size: 1.7" Diam. x 3.1"H, vertical PC board style mounting. Both are brand new. Limited quantity.
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NEW, "COLOR STEALTH CAM" MICRO SIZE, with AUDIO!

That's right! COLOR! In the same size package too! Sleek aluminum housing fits like a glove! Removeable mtg. bracket & a 1.3M cable with BNC vid., RCA aud., (internal mic) & DC pwr. jack for, no sweat hook up. Why fool around with an open P.C. board? Now you can have the "COLOR STEALTH CAM"

- 1/3" • 350 Lines
- Auto Shutter
- 270k pixels
- Focus:10mm to inf.
- 1<ounce!
- 0.7 Lux • AGC
- Pwr. 6-12V @30mA
- Std. 7 mm, 56° FOV lens
- NTSC video
- Size: 31mm sq. x 28mm d.

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NEW, BY POPULAR DEMAND, Universal Time and Date generator. Provides camera ID too!

Type TG-060, is only about the size of a pack of cigarettes but solves the problem of time stamping and identifying any video signal. Has RCA jacks for video in and out. Operates from 12VDC, AC adapter included. Super simple 3 button operation. Rugged plastic case with Velcro strip for easy placement. **TG-060....$49ea. 2/$89**

NEW, "STEALTH CAM", MICRO SIZE, with AUDIO!

The sleek aluminum housing fits like a glove! Removeable mtg. bracket & a 1.3M cable with BNC vid., RCA aud., (internal mic) & DC pwr. jack for, no sweat hook up. Why fool around with an open P.C. board? Now you can have the "STEALTH CAM"•1/3" CCD •410 Lines•0.3 Lux• AGC•Auto Shutter• Pwr. 12V @110mA•250k pixels•Std. 4mm, 78° FOV lens•Pinhole, 90° FOV• Focus:10mm to inf.•NTSC video•<ounce!• IR SENSITIVE • Size Std: 30mm sq. x 29mm d. PH: 16mm d, Don't confuse with LOW RES., HIGH LUX C-MOS CAMERAS **GM-2000S-STANDARD OR PINHOLE, with audio, SPECIAL...$69ea.**

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They are used in excellent condition. Specs: Res.380 Lines, S/N: 46dB, Sens. 7 lux. Size with lens: 10.75L x 4.5"W x 4.5"H. 1/1000 sec. electronic shutter for clear fast moving imagery. Supplied with users manual. New CA-10 cable New Panasonic WV-3203B power supply with video and audio RCA outputs as well! A $2800 package, very impressive. **WV-D5000 SYSTEM, Special.....$269ea. Complete.**

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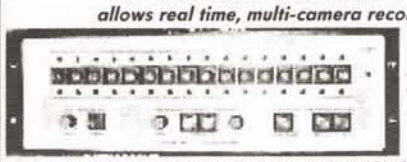

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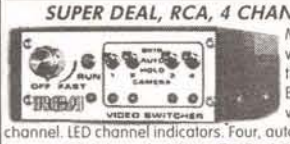
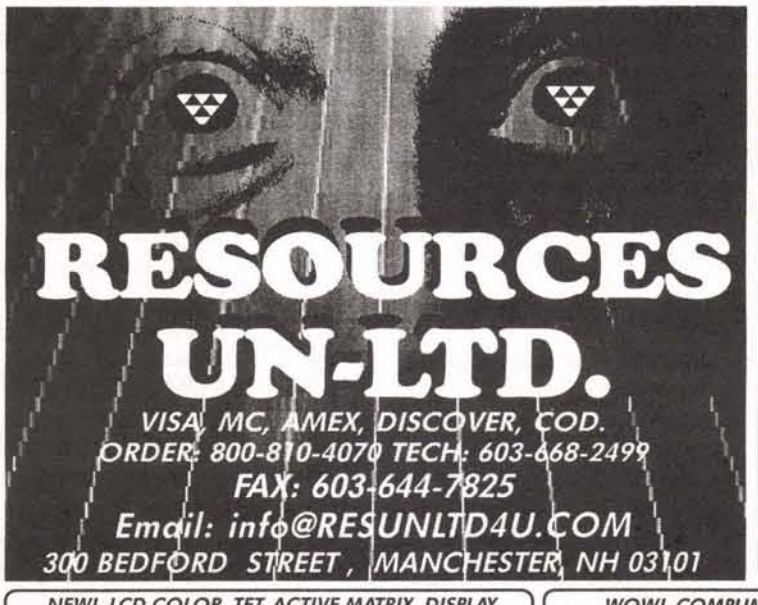
SUPER DEAL, RCA, 4 CHANNEL, VIDEO AUTO SWITCHER



Model TC-1404 . Connect up to four standard video signals to the rear panel BNC inputs and they will be sequentially output to a rear panel BNC video output. Front panel has adjustable, variable dwell time from 1 to 15 seconds per channel. LED channel indicators. Four, auto or manual toggle switches with channel bypass. Mini size only 4.2"W x 7.8"D x 1.2" H, ac powered. Video loop through. Direct 110VAC power. Used. **Special, TC-1404 Video Switcher...$49ea. 2 for $89**



END FIELD of VIEW GUESSWORK! 3.5 to 8mm VARI-FOCAL LENS

Brand New, super f1.8 lens allows you to smoothly adjust from a 97° FOV @ 3.5mm to a 44° FOV @ 8mm. Now you can frame your area of interest just the way you want it! Standard CS-Mount with adjustable focus and iris.
SPECIAL.....$79ea. or 2 for $149

WORLDS SMALLEST ••100mW•• VIDEO TRANSMITTER,

Incredibly only 0.9" x 0.8" x 0.37" Transmits crystal controlled hi-res. images with 100mW output! The transmitter you've been waiting for. Shown actual size. Much smaller than the 9V battery which powers it. Draws only 35mA! Factory tuned. Receive on cable channel 59. Will work with color or B&W cameras. UHF Bow tie antenna with balun and 3' F cable for TV Included. **TVX-100.....$159ea.**
TVX100 & GM200K-PH CAMERA.....$209set

NEW! LCD COLOR, TFT, ACTIVE MATRIX DISPLAY Offers a super 5.6" VIEWABLE AREA, Pro System with Custom Case, BUILT-IN 12V GEL CELL, all A/V cables and charger. Super Deal.

Pro System with Custom Case, BUILT-IN 12V GEL CELL, all A/V cables & charger. Super Deal. Finally we found a unit with exceptional quality at an affordable price. Perfect as a portable, general purpose color monitor for standard NTSC color or B&W video systems. Fully compatible with all our cameras as well as Camcorders, VCR's etc. Perfect as a rear view system with any video camera by virtue of its built in, mirror image function. Completely enclosed unit has adjustments for color, contrast, brightness & volume, for it's internal stereo speakers! A 1/4 x 20 Tripod socket & a tilt down stand for table to Inputs include: audio (L&R) and video on std. 1/8" mini jacks. External 12VDC on std. barrel connector. Specifications: 5.6", TFT active matrix LCD with 76.8K Pixels, CCFL backlight with 270cd/m Luminance, 500mW audio output available on std. 1/8" jack. 12V@600mA powered, 50mV min. or std. line level audio input. Size: 6.4"W x 5.25"H x 2.2D" First quality. Pro model includes: A luggage quality, custom made, padded case, dual removable straps for shoulder and/or holding at waist level for hands free viewing. Built into the case is a 12V Gel Cell, rechargeable battery plus a complete set of A/V cables. AC power adapter, power switch & charger.
GMTFT56-PRO $344ea. GMTFT56 Display only $299ea.

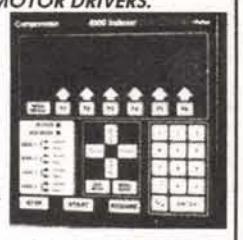
NEW, 9" SECURITY MONITORS,

Hi-resolution, 700 Line, B&W units. 90 day warranty. BNC video in and loop through. Rugged steel case. Current production model. Limited qty. They will make your video look super!
SPECIAL.....$99.00ea.

PORTABLE MINI PRINTER, 40 COLUMN, with INTERNAL NI-CAD POWER!

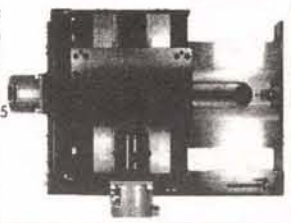
The model SD222-1000 is a NEW & very cool, self contained, alphanumeric/graphic, impact printer. Standard parallel port, internal Ni-Cad power supply. Can be powered via the 9VDC pwr. adapter supplied. Standard 2" paper and Epson ERC-09 ribbon (included) both available at Staples etc. Has self test & diagnostic mode. Can emulate Epson and Citizen 560. It will print from the LPT port of your PC. Very rugged & well made. Perfect for remote printing or data logging application. Size: 8"L x 4.1"W x 3.5"H. STD. **SPECIAL SALE.....$39ea. or 2 for $69**

WOW! COMPUMOTOR, 4000 MOTION CONTROLLER PLUS, TWO, SERIES LE, STEPPER MOTOR DRIVERS.



Motion, 1 to 4 axes of step & direction control. Accepts encoder position feedback.
I/O, Optically isolated programmable inputs (24) and outputs (24) compatible with industry standard signal conditioning products.
Features, 4000 Programmer/Operator Panel, Detachable can be mounted remotely. Dedicated jog function for each axis. Four-line, backlit, Liquid Crystal Display (LCD). Six soft-function keys labeled by the LCD change definition as needed. Sealed membrane keypad.
Language, Simple BASIC-like motion control program language. (No software supplied.) Multiple programs may be entered and saved. Feedrate override allows operator interaction. Insert, edit, copy & delete functions. User-defined operator prompts. Linear interpolation on up to four axes. Teach mode uses analog joystick (not supplied) inputs or operator panel jog keys.
Interface Capability, Remote programming capability over RS-232C and IEEE-488; remote program downloading and uploading. Second RS-232C port for operator messages or control of other devices. **Special System,.....COMP4000/LE....$1495 Ltd.Qty.**

DOVER AIR BEARING X/Y TABLE, is ULTRA PRECISE,



Like New, The ultimate in precision motion control. Leadscrew operated air bearing tables with 1-20 Microns typical repeatability. Straightness, <1 micron each axis, angular error, <1 arc/sec. Squareness, <5 arc/sec. Unit has 4"x5" travel with two Compumotor LE57-51-MTR steppers attached. Ready to play with our Compumotor 4000 series system above. **DOVER-B45..$949 with COMP4000/LE & cables $2250**

DC GEAR MOTOR, BUEHLER PRODUCTS, type 127K01880. SOLID CONSTRUCTION, HIGH TORQUE,

These are brand new, very rugged gearmotors. They offer a 5mm diameter x 9mm long, flatted output shaft, located off-center (approximately 10mm from the edge of the 35mm diameter gearbox.) Overall size: 35mm d x 73 mm L (including the shaft) with 2" red and black leads. The motors are rated at 17VDC nominal and provide the following speeds:

@VIN	I NO LOAD	RPM
12V	60mA	360
15V	62mA	457
17V	64mA	523

BUEHLER 127K.....$10ea. or 3 for $25

Events

CALENDAR

The Events Calendar is a free service for publicizing electronic events such as amateur radio hamfests, flea markets, etc. If your organization is sponsoring an event and would like a free listing, contact us at least 60 days in advance. Include your flyer, estimated attendance, name of the person to contact, and phone number.

Complimentary issues are available upon request for distribution to your attendees. A street address for UPS is required.

While we strive for accuracy in our calendar, we can not be responsible for errors or cancellations. The information contained in this column is for the use of the readers of *Nuts & Volts* and may not be republished in any form without the written permission of T & L Publications, Inc.

All listing information should be sent to:
Nuts & Volts Magazine
Events Calendar
430 Princeland Court
Corona, CA 92879
Phone 909-371-8497
Fax 909-371-3052
E-mail events@nutsvolts.com

MARCH 2001

March 2-3

FL - NEW PORT RICHEY - Hamfest. Fred K. Marchman Technical Education Center, 7825 Campus Dr. 8am-5pm. Talkin: 146.670. Gulf Coast ARC, Rick Brown KF4GXS, 727-863-1457. Email: richar@gte.net. Web: http://gcarc.cjb.net

March 3

AR - RUSSELLVILLE - Hamfest. Hughes Community Center, Knoxville & Parkway. 8am-4pm. Talkin: 146.820. AR River Valley AR Foundation, Margaret Alexander KC5MCS, 501-968-7270. Email: ealexand@cswnet.com Web: http://www.cswnet/com/~arvarf/hamfest.htm
CA - REDDING - Hamfest. Shasta Cascade ARS, Jim Bremer KE6OUA, email: ke6oua@aol.com
IA - COUNCIL BLUFFS - Hamfest. Southwest Iowa ARC, Rich Swig WA0ZQG, 712-256-7775. Email: wa0zqg@arrl.net
KY - CAVE CITY - Hamfest. Mammoth Cave ARC, Marty Edwards KC4BFF, 270-528-2447. Email: medwar@scrtc.com Web: http://www.scrtc.blue.net/mcarc
NJ - PARSIPPANY - Hamfest. PAL Bldg., 33 Baldwin Rd. VE session. Talkin: 146.985-PL 131.8. Splitrock ARA, Peter Glenn KC2KI, 973-442-0772 or 888-511 SARA. Email: splitrock@worldnet.att.net Web: http://ham.hsix.com/sara
OK - ELK CITY - Hamfest. West Central OK ARC, Earl Bottom N5NEB, 580-821-0633. Email: n5neb@logixonline.net

March 4

NY - LINDENHURST - Hamfest. Knights of Columbus Hall, 400 S. Broadway. 9am-2pm. VE exams. GSBARC & SCRC, Phil Lewis N2MUN, 631-226-0698. Email: info@gsbarc.org Web: http://www.gsbarc.org

March 10

AR - HARRISON - Hamfest. Harrison Junior High School Cafeteria, 515 S. Pine St. 8am-1pm. VE testing. North Arkansas ARS, Bill Rose N5VKF, 870-741-6968. Email: billrose@cswnet.com Web: http://www.qsl.net/naars
AZ - SCOTTSDALE - Hamfest. Scottsdale ARC, Roger Cahoon KB7ZWI, 480-948-1824 home, 602-725-7256 mobile. Email: rgcahoon@uswest.net
CA - LINDA - Hamfest. Yuba-Sutter ARC, Ron Murdock W6KJ, 530-674-8533
MO - KANSAS CITY - Hamfest. Ararat Shrine, 5100 Ararat Dr. Talkin: 145.13. Steve Dowdy WJ0I, 816-941-3392. Email: sdowdy@kc.rr.com
TN - KNOXVILLE - Hamfest. Kerbela Temple, 315 Mimosa Ave. 8am-4pm. Talkin: 144.83T/145.43R or 146.52 simplex. Kerbela ARS, Paul Baird K3PB, 865-986-9562
WA - PUYALLUP - Hamfest. Mike & Key ARC, Michael Dinkelman N7WA, 425-867-4797. Email: mwdink@eskimo.com

March 10-11

NC - CHARLOTTE - Hamfest & ComputerFair. Charlotte Merchandise Mart, 2500 E. Independence Blvd. The Mecklenburg ARS, Tom Hunt KA3VVJ, 704-948-7373 day & eves. until 9pm EST. Email: dealers@w4bfb.org Web: www.w4bfb.org/hamfest.html

March 11

MA - AMHERST - Hamfest. Regional Middle School, 170 Chestnut St. Talkin: 146.94- no PL. MTARA, Cindy Loiero K1ISS, 413-568-1175. Email: n1fi@arrl.net

March 17

CT - POMFRET - Hamfest. Eastern Connecticut ARA, Paul Rollinson KE1LI, 860-928-2456. Email: kelli@arrl.net
FL - FT. WALTON BEACH - Hamfest. Playground ARC, Louis Carter KF4HRM, 850-243-4315. Email: parcfest@aol.com Web: http://www.bsc.net/playground/
FL - STUART - Hamfest. Martin County Fairgrounds, 2616 S. Dixie Hwy. 8am-3pm. Talkin: 147.060. Martin County ARA, Romund Madson KS4KM, 561-337-1841
GA - MARIETTA - Hamfest. Kennehoochie ARC, Margaret Durham KB4QKW, 770-977-4405. Email: mjanewalls@aol.com Web: http://qsl.asti.com/hootch/karc-hamf_html
MI - MARSHALL - Hamfest. Marshall High School. 8am-3pm. Talkin: 146.66, 146.52 simplex. Southern MI ARS & Marshall High School Photo Electronics Club, Jim Holloway KG8GZ, 616-963-6602
WV - CHARLESTON - Hamfest. William H. (Jack) Kibler, Jr. K8WMX, 304-722-3150. Email: k8wmx@juno.com

March 17-18

LA - RAYNE - Hamfest. Acadiana ARA, L. "Al" Oubre K5DPG, 337-367-3901. Email: k5dpg@arrl.net Web: http://www.acadian.net/w5ddl
TX - MIDLAND - State Convention. Midland County Exhibit Bldg. Sat: 8am-5pm, Sun: 8am-2pm. VE exams. Midland ARC, Pete Stull WB7AMP, 915-686-6755 or 915-362-6644, email: W5QGG@arrl.net Larry Nix email: oilman29@home.com Web: http://www.w5qgg.org/

March 18

IL - STERLING - Hamfest. Sterling-Rock Falls ARS, Lloyd Sherman KB9APW, 815-336-2434. Email: lsherman@essex1.com
OH - MAUMEE - Hamfest. Lucas County Recreation Center, 2901 Key St. 8am-2pm. Talkin: 147.27+. TMRA, Paul Hanslik N8XDB, 419-385-5056. Web: www.tmrahamradio.org
WI - JEFFERSON - Hamfest. Tri-County ARC, John Satterlee WA9SAB, 920-563-6381 eves. Email: tricountyarc@globaldialog.com

March 24

CANADA - ONTARIO - BRAMPTON - Hamfest. Peel and Mississuaga ARCs, Michael Brickell VE3TKI, 905-826-5176. Email: ve3tki@rac.ca
MN - ST. PAUL - Hamfest. Concordia University, Ganglehoff Center, 235 Hamline Ave. 8:30am-3pm. VE testing. Robbinsdale ARC, Harriet Johanson KB0UPH, 763-537-1722. Email: k0ltc@visi.com Web: http://www.visi.com/~k0ltc
WV - BECKLEY - Hamfest. Plateau ARA & Black Diamond ARC, James Martin KC8JSZ, 304-465-1428. Email: w373@inetone.net

March 24-25

FL - SARASOTA - Show. Sarasota Municipal Auditorium, 801 N. Tamiami Trl. Frank Cox 941-954-0202

March 25

IL - GRAYSLAKE - Hamfest. Lake County Fairgrounds. VE testing. Talkin: 146.52 simplex. North Shore RC, Jacob Fishman KF9ZF, 847-291-4160. Email: kf9zf@arrl.net Web: http://www.ns9rc.org
NC - KINSTON - Hamfest. Down East Hamfest Assn., Doug Burt W4OFO, 252-524-5724. Email: jeanhd@icomnet.com
OH - MADISON - Hamfest. Lake County ARA, Roxanne N8BC, 440-209-8953 (9am to 9pm). Email: tbrown@ncweb.com Web: http://hamradio.org/lcara
PA - MONROEVILLE - Hamfest. Palace Inn. 8:30am-3pm. Two Rivers ARC, Roxane Gaal WB3ROX, 412-823-6613. Email: gaal@pgh.net Web: http://www.qsl.net/w3oc/hamfest.htm

March 30-31

NE - NORFOLK - Convention. Northeast Community College Lifelong Learning Center, 801 E. Benjamin Ave. VE testing. Talkin: 146.730-. Elkhorn Valley ARC, Sam Seikaly WA6BRE, 402-379-4073. Email: sseikaly@conpoint.com Web: http://www.qsl.net/evarc/

March 31

CT - WATERFORD - Auction. Waterford Senior Center, Rt. 85. Talkin: 146.730-. RASON, Mark Noe KE1IU, 860-536-9633. Bruce Adams KA1ZMZ, 860-886-1837. Email: badams01@aol.com Web: http://www.rason.org
KY - ELIZABETHTOWN - Hamfest. Lincoln Trail ARC, Leon Priest N4TFK, 270-351-4721. Email: n4tfk@qsl.net Web: http://www.qsl.net/w4bej
TX - BRENHAM - Hamfest. Brenham ARC, Dan Lakenmacher N5UNU, 979-836-8739. Email: lindan@pointcom.net Web: http://www.alpha1.net/~barc

March 31-April 1

MD - TIMONIUM - Greater Baltimore Hamboree & Computerfest/MD State ARRL Convention. Timonium Fairgrounds, York Rd. Baltimore ARC, Sharon Dobson N3QQC, 410-HAM-FEST or 800-HAM-FEST. Email: k3duh@amsat.org Web: http://www.gbhc.org

APRIL 2001

April 1

CT - SOUTHINGTON - Hamfest. Southington High School. Talkin: 145.49, 224.80, and 444.25. Southington ARA, Chet Bacon KA1ILH, 860-628-9346. Email: ka1ilh@chetbacon.com Web: http://www.chetbacon.com/sara/htm

April 6-7

WI - MILWAUKEE - AES Superfest 2001. Amateur Electronic Supply, Ray Grenier K9KHW, email: rayk9khw@aol.com

April 7

IN - COLUMBUS - Hamfest. Bartholomew County 4H Fairgrounds, Community Bldg., State Rd 11. 8am-2pm. Talkin: 146.790/146.190. Columbus ARC, Marion Winterberg WD9HTN, 812-342-4670. Email: carc_in@yahoo.com
MO - LEBANON - Hamfest. Lebanon ARC, Chuck Sears AA0RK, 417-589-8122. Email:

COMPUTER SHOWS

AGI Shows, 317-299-8827
E-Mail: info@agishows.com
http://www.agishows.com

Blue Star Productions
612-788-1901
http://www.supercomputersale.com

Computers And You, 734-283-1754
www.a1-supercomputersales.com

Computer Central Shows
630-782-4625 Fax 630-834-2594
E-Mail: cc@gats.com
www.computercentralshows.com

Computer Country Expo
847-662-0811 Web: www.ccxpo.com

Five Star Productions
810-379-3333 E-Mail: jeff@fivestar
www.fivestarshows.com

Gibraltar Trade Center, Inc.
734-287-2000 Taylor, MI.
E-Mail: taylor@gibraltartrade.com
www.gibraltartrade.com

Gibraltar Trade Center, Inc.
810-465-6440 Mt. Clemens, MI.
E-Mail: mtclemens@gibraltartrade.com
www.gibraltartrade.com

KGP Productions
1-800-631-0062, 732-297-2526
E-Mail: kgp@mail.com

MarketPro, Inc., 201-825-2229
http://www.marketpro.com

MarketPro, Inc., 301-984-0880
E-Mail: md@marketpro.com
http://marketpro.com

ComputerShow
770-663-0983
E-Mail: narisaam@aol.com
Web: http://www.shownsale.com

Northern Computer Shows
978-744-8440
E-Mail: inquiries@ncshows.com
Web: ncshows.com

Peter Trapp Computer Shows
603-272-5008
Web: www.petertrapp.com

Events CALENDAR

freedom1@advertisnet.com
NH - LONDONDERRY - Hamfest. Lion's Club Hall, Mammoth Rd., Rt. 128. VE sessions. Talkin: 146.850-/PL 85.4. Interstate Repeater Society, Paul Gifford K1LL, 603-883-3308. Email: K1LLX@juno.com

April 8

NC - RALEIGH - Hamfest. NCS Fairgrounds, Jim Graham Bldg. 8am-4pm. Raleigh ARS, Chuck Littlewood K4HF, 919-872-6555. Email: k4hf@arrl.net
Web: http://www.rars.org
WI - STOUGHTON - Hamfest. Mandt Community Center, Stoughton Junior Fairgrounds. Talkin: 147.150. Madison Area Repeater Assn., Paul Toussaint N9VWH, 608-245-8890. Email: n9vwh@arrl.net
Web: http://www.qsl.net/mara/

April 20-21

AR - LITTLE ROCK - Hamfest. Expo Center. Fri: 4pm-8pm, Sat: 8am-4pm. Jim Blackmon K5VZ, 870-246-6734 office, 870-246-7833 home. Email: k5vz@ezclick.net
Web: http://www.aristotle.net/~hamfest

April 21

FL - TAMPA - Hamfest. Tampa ARC, Biff Craine K4LAW, 813-265-4812.
Email: k4law@arrl.net
Web: http://www.hamclub.org
NC - MORGANTON - Hamfest. Burke Co. Fairgrounds. Talkin: 146.745. Catawba Valley, Tom 828-433-6205, Larry: af4hx@worldnet.att.net
NJ - WEST ORANGE - Hamfest. West Orange High School, 600 Pleasant Valley Way. 8:30am-1pm. VE session. IRAC, Jim Howe N2TDI, 973-402-6066. Email: jimn2tdi@att.net Web: www.qsl.net/k2gq
OH - COALTON - Hamfest. Jackson County ARC, Edgar Dempsey KD8XL, 740-286-3239. Email: kd8xl@ohiohills.com
VA - CHESAPEAKE - Hamfest. Chesapeake ARS, Richard Siff WA4BUE, email: melody@pilot.infi.net
TX - BELTON - Hamfest. Bell County Expo Center. Talkin: 146.820-, PL 123. Temple ARC, Mike LeFan WA5EQQ, 254-773-3590. Email: hamexpo@tarc.org
Web: http://www.tarc.org

April 28

CA - SONOMA - Hamfest. Sonoma Valley Veteran's Memorial Bldg., 126 First St. W. 8am-12pm. VE exam. Talkin: 145.35, -600, PL 88.5. VOMARC, Darrel Jones WD6BOR, 707-996-4494
SC - WINDSOR - Hamfest. Salkehatchie ARS, Adam Hoffman AF4QZ, 803-245-4673. Email: af4qz@arrl.net Web: http://www.qsl.net/kf4cvo

April 29

IL - ARTHUR - Hamfest. Moultrie/Douglas County Fairgrounds. 8am-1pm. Talkin: 146.055/146.655 and 449.275/444.275. Moultrie ARK, Ralph Zancha WC9V, 217-543-2178 days or 217-873-5287 eves. Email: rzancha@one-eleven.net
OH - ATHENS - Hamfest. Athens County ARA, Drew McDaniel W8MHV, 740-592-2106. Email: dmcdaniel1@ohiou.edu
OH - CANFIELD - Hamfest. Mahoning County Career and Technical Center, 7300 N. Palmyra Rd. 8am-2pm. VE exams. Twenty Over Nine Radio Club, Don Stoddard N8LNE, 330-793-7072. Email: n8lne1@juno.com
PA - WASHINGTON - Hamfest. Washington Amateur Communications Club, Jim Burtoft KC3HW, 724-228-0546. Email: jbur@mlynk.com

MAY 2001

May 5

AZ - SIERRA VISTA - Hamfest. Cochise ARA, Robert Warren KF7TJ, 520-803-1453. Email: warnel@juno.com Web: http://www.qsl.net/k7rdg
MI - CADILLAC - Hamfest. Cadillac Junior High School. 8am-12pm. VE exams. Talkin: 146.980/K8CAD-R. Wexaukee ARC, Rick Hockridge K8WZS, email: k8wzs@arrl.net
SC - GREENVILLE - Hamfest. Blue Ridge ARS, Bob Watson W4RGW, 864-833-2204. Email: w4rgw@arrl.net Web: http://www.brars.org
WI - CEDARBURG - Hamfest. Ozaukee Radio Club, Gene Szudrowitz KB9VJP, 262-377-6792. Email: szudg@msn.com

May 5-6

AL - BIRMINGHAM - Hamfest. Zamora Temple. Sat: 9am-5pm, Sun: 9am-4pm. FCC exams. Talkin: 146.88. BARC, Glenn Glass KE4YZK, 205-681-5019.
Email: ke4yzk@bellsouth.net
Web: http://www.w4cue.com
TX - ABILENE - West TX State Convention. Abilene Civic Center. Sat: 8am-5pm, Sun: 8am-2pm. VE exams. Talkin: 146.160/760. Key City ARC, Peggy Richard KA4UPA, 915-672-8889. Email: ka4upa@arrl.net Web: http://www.angelfire.com/tx/kcarc76/hamfest.html

May 6

IL - SANDWICH - Hamfest. Sandwich Fairgrounds. 8am-1pm. Talkin: 146.73- or 146.52 simplex. KARC, Bob Yurs W9ICU, 815-895-3310. Email: w9icu@home.com http://tbcnet.com/~jleonard/hamfest.htm
MD - HAGERSTOWN - Hamfest. Washington County Agricultural Center. VEC exams. Talkin: 147.090. Antietam Radio Assn., Carl Morris WN3DUG, 717-267-3411. Email: morriscw@cvn.net Web: http://www.qsl.net/w3cwc
NY - YONKERS - Flea Market. Lincoln High School, Kneeland Ave. 9am-3pm. VE Exams. Talkin: 440.425 PL 156.7, 223.760 PL 67.0, 146.910, 443.350 PL 156.7. Metro 70cm Network, Otto Supliski WB2SLQ, 914-969-1053. Email: wb2slq@juno.com
Web: http://www.metro70cmnetwork.com
PA - WRIGHTSTOWN - Hamfest. Middletown Grange Fairgrounds. VE testing. Talkin: 147.09 and 443.950. Warminster ARC, Tony Simek N3YNH,

Events CALENDAR

215-674-5218. Email: tsimek@aol.com Web: www.voicenet.com/~juno.com
WV - RIPLEY - Hamfest. Jackson County ARC, Valerie Hunter KC8PPT, 304-372-9518. Email: salamander54_25239@yahoo.com

May 12

OK - EUFAULA - Hamfest. Community Center, corner of High & First St. Talkin: 146.955 -600, 144.250 USB. Lake Eufaula Hamfest, Mark Magreevy N5PNE, 918-689-5366. Email: n5pne@yahoo.com Web: http://go.to/eufaulahamfest
WA - STANWOOD - Hamfest. Stanwood-Camano ARC, Dave Huppert KA7FDC, 360-387-6123. Email: huppert@whidbey.net

May 18-19-20

OH - DAYTON - Hamvention. Dayton ARA, Jim Graver KB8PSO, 937-276-6930. Email: info@hamvention.org Web: http://www.hamvention.org/

JUNE 2001

June 1-2-3

NY - ROCHESTER - Atlantic Division Convention. Monroe County Fairgrounds, Rt. 15A. Fri: 6am-5:30pm, Sat: 8:30am-5:30pm, Sun: 8:30am-1:30pm. Rochester ARA, Harold Smith K2HC, 716-424-7184. Email: harold@rochesterhamfest.org Web: http://www.rochesterhamfest.org
OR - SEASIDE - Northwestern Division ARRL Convention. Convention Center. SEAPAC, Randy Stimson KZ7T, 503-297-1175. Web: www.seapac.org

June 2

GA - MARIETTA - Convention. Jim Miller Park. 9am-4pm. License Exams. Talkin: 146.82-. Atlanta RC, Gwinnett ARS, & Paulding ARC, John Talipsky, Jr. KA4VQH, 770-995-6446. Email: johnka4vqh@aol.com Web: http://www.saf.com/arc/atlfest.htm
IL - SPRINGFIELD - Hamfest. Sangamon Valley RC, Edmund Gaffney KA9ETP, 217-628-3697. Email: egaffney@family-net.net Web: http://www.w9dua.net
MI - GRAND RAPIDS - Hamfest. Hudsonville Fairgrounds. VE exams. Talkin: 147.16. IRA, Kathy KB8KZH, 616-698-6627 between 4-7pm EST. Web: www.iserv.net/~w8hvg

June 3

IL - PRINCETON - Hamfest. Bureau County Fairgrounds. Talkin: 146.955 -600 PL 103.5. Starved Rock RC, Jerry Hagemann N9ZJK, 815-538-6932. Email: w9mkshamfest@hotmail.com Web: http://www.qsl.net/w9mks
VA - MANASSAS - Hamfest. Ole Virginia Hams ARC, Mary Lu Blasdell KB4EFB, 703-369-2877. Email: mblasd1638@aol.com Web: http://www.qsl.net/olevahams

June 9

MO - MACON - Hamfest. Macon County, Tri-County, Nemo, & Schuyler County ARCs, Dale Bagley K0KY, 660-385-3629. Email: n0pr@arrl.net Web: http://www.istmacon.net/~kfoster/hamfest.htm
PA - BLOOMSBURG - Eastern PA Section Convention. Columbia-Montour ARC, George Law N3KYZ, 570-784-2299. Email: n3kyz@jlink.net Web: http://www.bafn.org/~cmarc
WI - EAU CLAIRE - Hamfest. Eau Claire ARC, Jim Staatz KG9RA, 715-838-9108. Email: w9eau@ecarc.org Web: http://www.ecarc.org

June 10

IL - WHEATON - Hamfest. Six Meter Club of Chicago, Joseph Gutwein WA9RIJ, 630-963-4922 or 708-442-4961. Email: wa9rij@mc.net Web: http://www.cyberconnect.com/orion/smcc.html
KY - INDEPENDENCE - Hamfest. Northern KY ARC, Robert Blocher N8JMV, 513-797-7252. Email: nkarc@juno.com Web: http://home.fuse.net/dom/
OH - SUFFIELD (AKRON) - Hamfest. Goodyear ARC, Rich Kuster N8ZDQ, 330-796-3951. Email: rich.kuster@goodyear.com
NY - BETHPAGE - Hamfest. Long Island Mobile ARC, Ed Muro KC2AYC, 516-520-9311. Email: hamfest@limarc.org Web: http://www.limarc.org

June 16

NJ - DUNELLEN - Hamfest. Raritan Valley Radio Assn., Doug Benner W2NJH, 732-469-9009. Email: wb2njh@aol.com Web: http://www.w2qw.com

June 23-24

CA - FERNDALE - State Convention. Humboldt ARC, Redwood ARC, Farwest Repeater Assn., & Southern Humboldt ARC, Marci Campbell K36IAU, marcidon@quik.com Web: http://www.geocities.com/ciem95501

JULY 2001

July 1

PA - WILKES-BARRE - Hamfest. Murgas ARC, Bob Michael N3FA, 570-288-3532. Email: wb3faa@aol.com

July 4

PA - BRESSLER - Hamfest. Emerick Cibort Park. W3UU, Pete deVolpi K3PD, 717-705-1370 weekdays. 717-938-8249 eves 6-9pm & weekends. Email: w3uu@aol.com Web: http://members.aol.com/w3uu/

July 7

IN - INDIANAPOLIS - Central Division Convention. Indianapolis Hamfest Assn., Rick Ogan N9LRR, 317-257-4050. Email: oganr@in.net Web: http://www.indyhamfest.com

July 8

IL - PEOTONE - Hamfest. Kankakee Area Radio Society, John "Chip" Moore K9IOC, 815-933-1323. Email: karsfest@yahoo.com Web: http://www.w9az.com

July 14

GA - GAINESVILLE - Hamfest. Lanierland ARC, Terry Jones W4TL, 770-967-6364. Email: w4tl@arrl.net Web: http://www.mindspring.com/~w4tl/hamfest.htm
TX - TEXAS CITY - Hamfest. Tidelands ARS, Joe Wileman AA5OP, 409-945-6794. Email: aa5op@aol.com Web: http://www.tidelands.org

July 15

PA - KIMBERTON - Hamfest. Mid-Atlantic ARC, Bill Owen W3KRB, 610-325-3995. Email: gem@op.net Web: http://www.marc.org/hamfest.html

July 22

IL - SUGAR GROVE - Hamfest. Waubonsee Community College, Rt. 47 at Harter Rd. VEC exams. Talkin: 147.210 (+600) PL 103.5/107.2. Fox River Radio League, POB 673, Batavia, IL 60510-0673. Web: http://www.frrl.org/hamfest.html

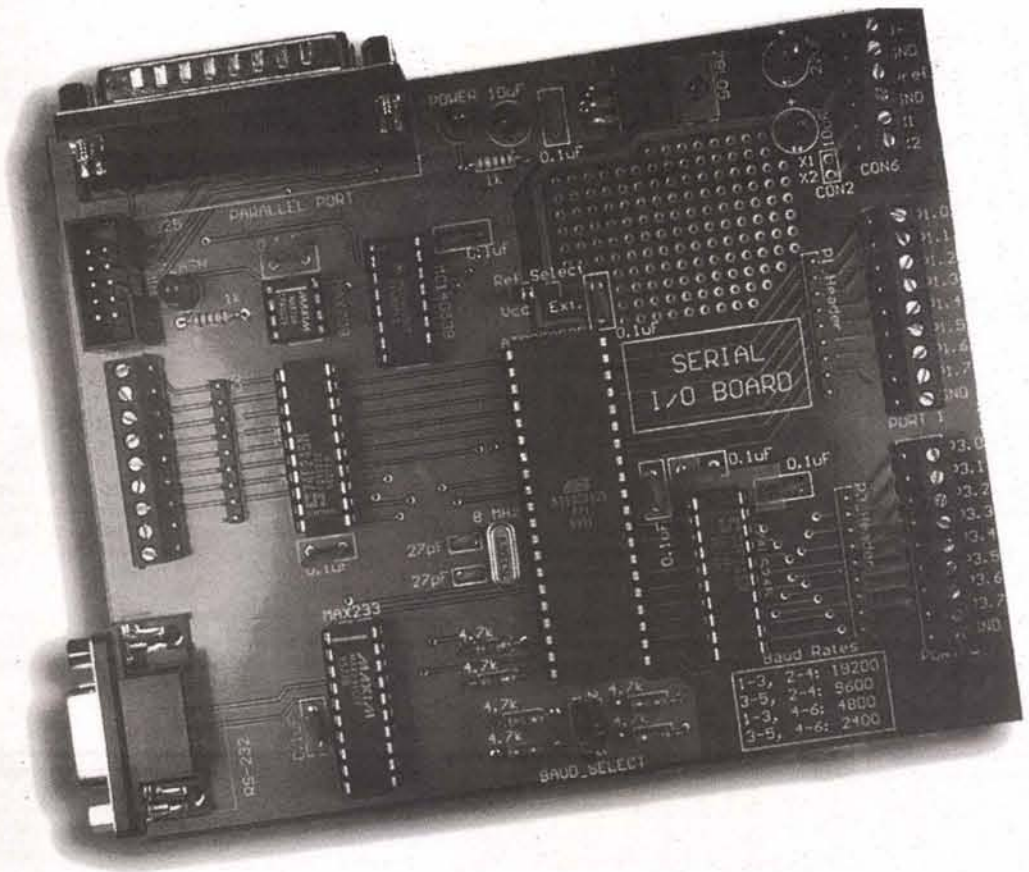
July 28

OH - CINCINNATI - Hamfest. OH-KY-IN ARS, Mr. Lynn Ernst WD8JAW, 859-657-6161. Email: wd8jaw@arrl.net Web: http://www.qsl.net/k8sch

Write in 57 on Reader Service Card.

Build an RS-232 Serial I/O Board — Part 2

by Ben, Phil, and John Bright



Hardware Events

In the article introduction last month, we mentioned that the serial I/O board offers an alternative to constant polling when you want to detect switch closures or monitor some other type of input data. This feature of the serial I/O board is something we call "hardware events" or sometimes just "events." The basic concept behind hardware events is that the serial board itself takes over the job of monitoring input pins, instead of leaving it up to the controlling PC.

We recently used this I/O board in a woodworking shop, which belongs to a brother of ours. We wanted to use a PC to control some ventilation fans and an outdoor floodlight so that he could control these devices from a web browser anywhere on the local network (or with an Internet connection, from anywhere in the world!). He also needed to have convenient wall-mounted push-button switches to control these devices while he was in the shop. We connected each of these momentary push buttons to a separate input bit on the I/O board, and each fan and light was switched by a separate relay connected to a corresponding output bit.

On the software side, a traditional technique for this type of situation would have been to set up a polling loop in the PC application. This loop would constantly poll the I/O board for the status of the input bits that are connected to the push buttons. When it detected that a push button had been pressed, it would turn on the relay that controls the device. However, there are several problems with this technique: it wastes CPU time; it can sometimes be difficult to work into your code; and it generates a lot of traffic on the serial link to the I/O board.

The hardware events feature of this serial I/O board offers a much better solution to all of this. Instead of the PC constantly asking the I/O board for the status of the switches, the I/O board itself can monitor the switches and send the PC a message when the switch changes state! In essence, the I/O board is telling the PC "don't keep asking me about the switch — I'll tell you when something happens."

You might be wondering how your application will know when the message arrives. The software libraries that we supply for the project hide most of the details involved, but basically you supply a callback function which will be automatically executed when a hardware event occurs. Parameters will be passed to your function, indicating which bit or byte on the I/O board was involved. For those of you not familiar with callbacks, don't worry. The concept is rather simple. To put it loosely, a callback function is just some code you write that will be automatically executed when certain conditions are met. The documentation included in the accompanying download for this project explains how to register your callback function with the software library.

Hardware Events Implementation

This serial I/O board has two different types of events that are available: byte events and bit events. A byte event is defined as a change in state on a digital I/O port. When a byte event is enabled for a port, the serial board will send a message to the host PC whenever any of the bits on that port change state. A bit event is defined as a change in state on a specific bit on a digital I/O port. When a bit event is enabled for a bit on a port, the serial board will send a message to the host PC whenever that specific bit changes state. On a given I/O port, either byte events or bit events can be enabled or disabled, but not both types at the same time. Also, although this board has analog support on port 1, no events are available for that port when it is in analog mode.

Events are generally intended to be used on a port that is configured as an input port, but this is not a requirement. The event-checking routine in the firmware does not make any distinction between inputs and outputs. This feature can be used for testing, diagnostics, or even as confirmation that a new value has been written to a port. In other words, by configuring a port as an output port, and enabling an event on that port or a bit on that port, the user can generate an event by sending a new value to that port or bit.

While hardware events are very handy in many situations, it is important to understand that they do

TABLE 1

Command	Action	Example
En	enable buffer for port n	E1
Xn	disable buffer for port n	X1
Sn,d	set port n as input or output	S1,1
In	read in data on port n	I1
in.b	read bit b on port n	i1.1
On=d	output d	O1=25
on.b=d	output bit value d on bit b of port n	o1.5=0
Vn	byte events enabled for port n	V1
vn.b	bit event enabled for bit b of port n	v1.3
Cn	disable all events for port n	C1
cn.b	disable event for bit b of port n	c1.3
L	toggles between CR and CR/LF	L
I	identify the board	I
P	ping	P
D	set port 1 for digital mode	D
A	set port 1 for analog mode	A
a.n	read analog value on channel n of port 1	a.2

have some limitations. An event must last for a certain period of time in order for it to be detected by the microcontroller. The firmware implements a polling loop, which checks the pins for events just as fast as it can. Still, if a pin changes state and then returns to its original state too quickly, the micro cannot detect the event. Exactly what "too quickly" is can be difficult to define, because it varies based on what is happening on the serial board, and even on how many events are enabled. Still, under normal operation, when the serial board has finished processing all commands, and there is no serial activity, you can expect the board to catch an event if it lasts for at least 10 microseconds.

Firmware Logic Discussion/Flowchart

The firmware that runs on the Atmel microcontroller was written in assembly language. Space prevents including the source here, but both the source code and the compiled hex file are included in the accompanying download for this project (see the Resources sidebar).

Note that you don't have to analyze or understand the code in order to build this project. As described in the last issue, you can simply download the already assembled program into the microcontroller and be done with it. However, the source code is available for those of you who want to customize it to suit your special needs. In any case, to give you a general understanding of the firmware, here is an overview of the tasks it performs:

1) System Initialization: Sets up the stack pointer and buffer pointers, initializes I/O ports and data registers, configures the UART, enables interrupts, etc.

2) Serial Communications: The micro's built-in UART makes it easy to send and receive data and commands from the host computer.

3) Command Storage and Retrieval: A circular buffer is used as a queue for commands received from the host computer (more on this below).

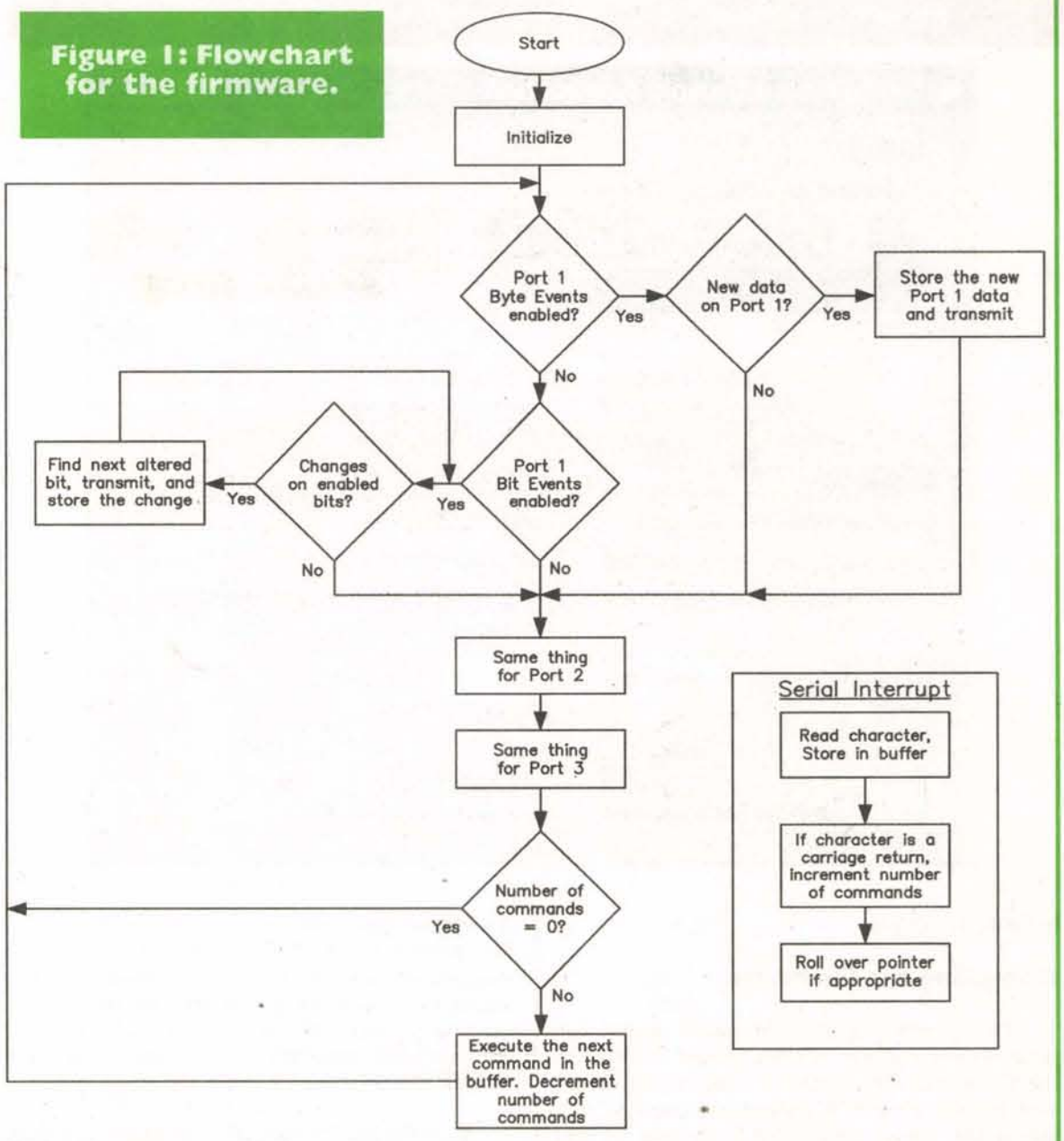
4) Command Processing and Execution: After a complete command has been received from the host computer and stored in the buffer, it is processed and executed.

5) Event Reporting: The firmware monitors the I/O pins for the occurrence of any hardware events that have been enabled (the concept of events was discussed above).

The overall program flow of the firmware is illustrated in Figure 1. In essence, the main loop is comprised of checking for hardware events that have occurred on event-enabled ports or bits, calling the appropriate functions to deal with events, and calling a function to process the next command when the number of commands is greater than 0. Note that if events are enabled at the byte-level, then events at the bit level are not checked for that port.

The buffering strategy mentioned in task 3 deserves an explanation. In order to make sure that no incoming characters are lost, a buffer is set up to store the characters as they are received. Each time a serial character is received by the UART, an interrupt routine is called to store the character in the buffer. The interrupt routine stores the character in the location indicated by a "Write Pointer" and then advances the pointer. A circular buffering technique is used, meaning that when the write pointer approaches the end of the buffer, a "rollover" occurs, resetting the pointer to the beginning of the buffer, and new characters will now overwrite the old characters that have already been processed. In our implementation, the pointer is not forcibly rolled over as soon as it reaches a certain point. Instead, a pointer is only rolled over after the end of a complete command (marked by a carriage return) if the pointer has reached the Rollover Threshold. This technique ensures that a rollover will not occur in the middle of a command, leaving the command split between start and end. After a complete command is received, it is retrieved and executed. See Figure 2 for an illustration of this

Figure 1: Flowchart for the firmware.



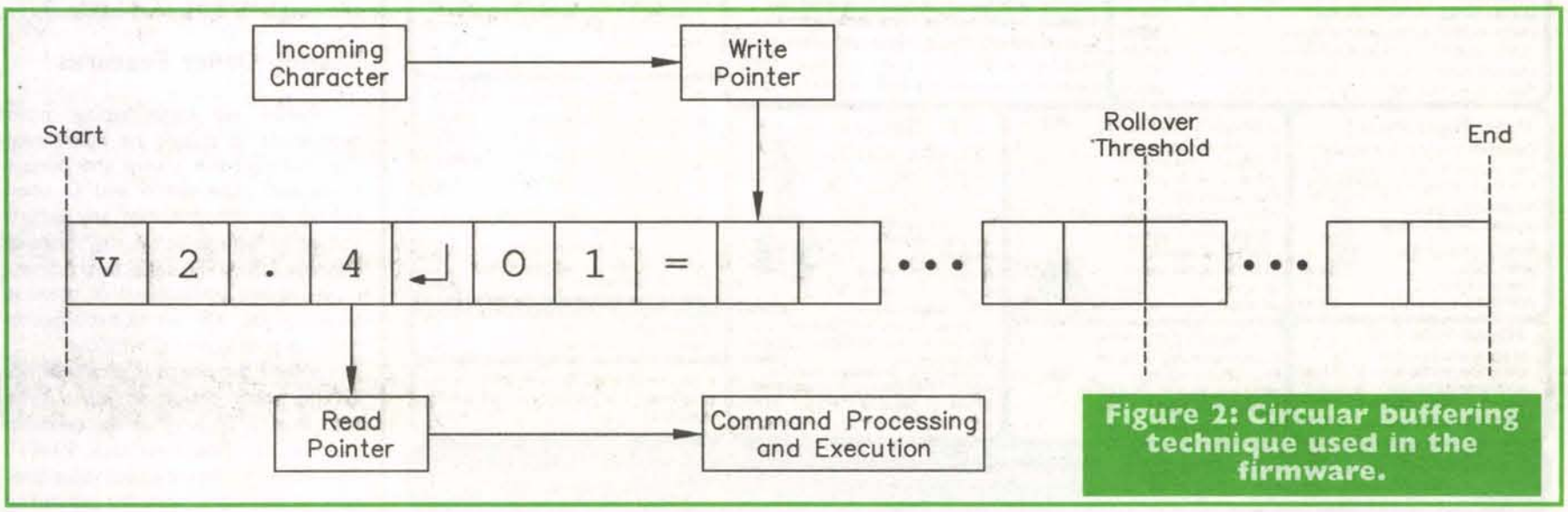
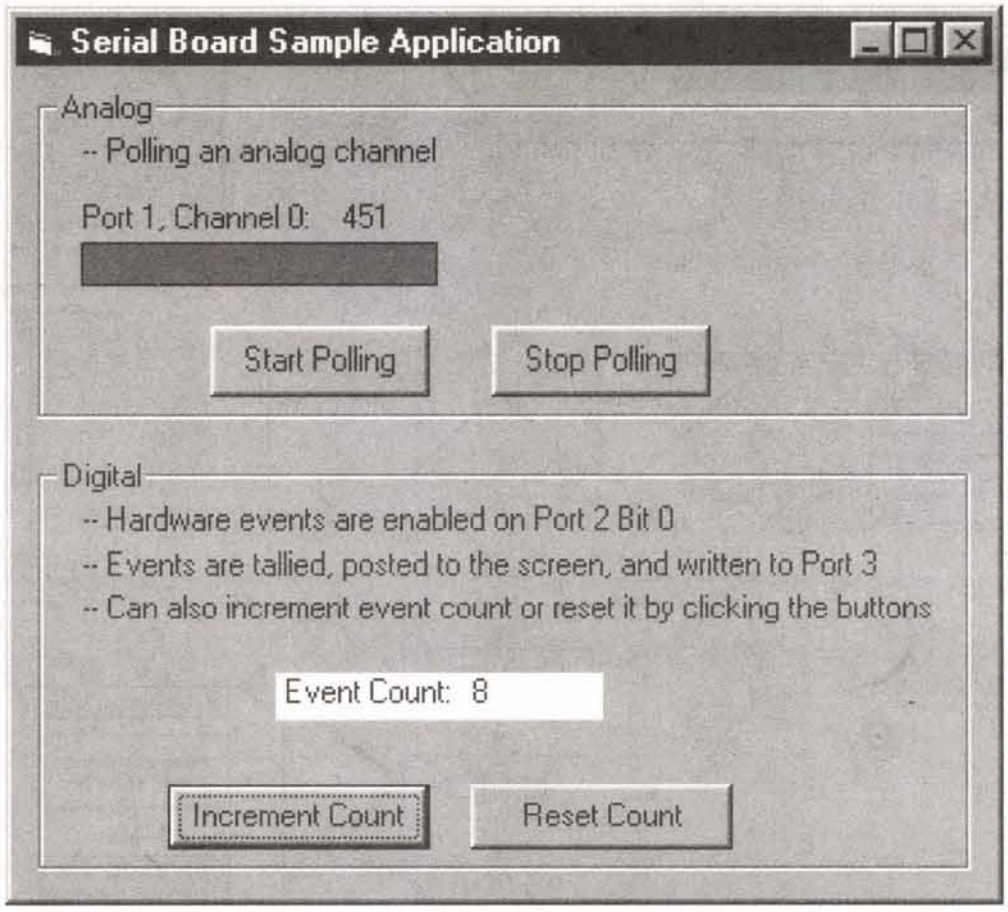


Figure 2: Circular buffering technique used in the firmware.

Figure 3: Visual Basic sample application screenshot.



buffering technique.

Compiling the Firmware

The original compiled firmware needed for programming the micro in this project is stored in the file serbrd.HEX, which is included in the download for this project. If you do not need to customize the firmware, then this is the only file you need and you can simply program this file into the microcontroller, as described in the last issue.

For the adventurous people who want to tweak the firmware, you will find the entire source in the file SerBrd.ASM, which is also included in the download. You will need to run this file through the AVR assembler in order to get the HEX file that will be used to program the micro. If you are using the command-line assembler that comes with the STK200 development kit, you could simply enter:

```
C:\AVRTOOLS> avrasm serbrd.asm serbrd.lst
serbrd.hex
```

You now have a file called serbrd.hex.

The STK200 also includes an assembler program that runs in the Windows environment. It is a handy program; however, if you were to attempt to open the firmware source code with this program, you would be sadly disappointed. For one reason or another, this program cannot open files that are this large. Perhaps this has been taken care of in Atmel's development software that can be downloaded from their site, but we have not tried it.

Testing the Board

Once you have assembled your board and programmed the firmware into the microcontroller, you are ready to test your board. Here are a few guidelines to keep in mind as you begin testing. Since the board has on onboard 5V regulator, supply about 7-8V DC to the board. For the serial connection, use a straight-through serial cable, as opposed to a crossover (null-modem) cable. This means that all the pins on one end of the cable go to the same pin number on the other end of the cable. No pins are crossed over.

Determine which PC serial port you are using (COM1, COM2, etc.). The settings on your serial port should be eight bits, no parity, and one stop bit (8N1). Also be sure you set your serial port to the same baud rate that the serial board jumpers are set for.

We will now use a simple terminal application to connect to the serial board, test it, and look at a few of the things it can do. For those who may be unfamiliar with a terminal program, it is simply an application which allows you to type characters at your keyboard, and send them to a serial port on your computer. You can also see any incoming data, as well.

You can use any terminal program you are familiar with. Windows comes with a terminal called HyperTerminal. Freeware terminal programs are also available (see Resources for details). You will have to enter a few settings (serial port, parity, stop bits, etc.). Then connect to the board.

Take a look at the list of the serial board commands in Table 1. Note that you will not normally use these commands directly in the software applications that you write. Instead, you will call functions in the provided software library, and the library will take care of the low-level commands. We are using the low-level commands right now for testing and demonstration purposes.

First, we will 'ping' the board to test the serial link. This is a simple command/response situation. Type a 'P' in the terminal window and hit 'Return' (note that all commands are case-sensitive and should be followed by 'Return'). If all is well, you should see a 'G' for the response. This means that the I/O board received the 'P' and sent a 'G' back to the PC.

Testing Other Features

Before we begin typing more commands, it should be mentioned that many of the set-up and output commands (like the S and O used below) do not generate any return output for you to see in the terminal window. Also, if the serial board doesn't recognize a command, or there is an error, you will see an exclamation point in your terminal window.

When the board is powered up, all the ports default to input. Let's read Port 3. Type 'I3' in the terminal window. You should get back 'P3=FF'. The 'FF' is the hexadecimal value present on the input port. Try grounding

a couple of the input pins on Port 3 and read it again. You should see the value change.

To output data, we must first configure the port as an output port. We will use Port 2 in this example. Type 'S2,1' to configure Port 2 as output (you won't see any returned characters). Now, type 'O2=FF' to turn on all the bits of Port 2. You can easily verify this with a logic probe or some LEDs.

Finally, we will demonstrate what happens when hardware events occur. Event detection is disabled by default, so we will have to send a command to enable events on the line we are interested in. If Port 3 is no longer in input mode, send a 'S3,0' command to put it back in input mode. Connect a momentary switch between ground and bit 0 on Port 3.

Send the command 'v3.0' to enable events on bit 0. Finally, close and open the switch a couple of times. You should see the message 'b3.0=1' or 'b3.0=0' appear in the terminal window every time the switch changes state. You can see how the I/O board automatically sends messages to the PC when the input changes.

You might want to explore some of the other commands in the list. There is not space to deal with them all here, but you get the idea of how things work. Input, output, and event commands are available for individual bits or entire ports. More extensive documentation on the commands is available in the download for this project.

PC Software Libraries

The terminal provides a nice way to play around with the serial board, but the included software library for this board provides a superior method for controlling the board in your applications. It provides convenient, consistent access to the board and maximizes its capabilities. It is available for C or C++ on Windows and Linux, and a special class module provides full support for Visual Basic.

Another term for a software library is an Applications Programming Interface, or API for short. A major benefit of using our API is that the programmer does not need to know much about how the serial board works, nor how to perform low-level serial communications. Because the programmer doesn't need to keep track of numerous details, the API helps to avoid frustrating mistakes and bugs. Another benefit of using an API is that it encourages consistency in programming. Common tasks will always be handled in a similar fashion, making programs easier to understand and maintain.

Also, as mentioned in the section on hardware events, the serial board sends a message to the PC whenever an enabled event changes state. Without the API, this incoming message — which could arrive at any given time — might be difficult to deal with. But the included API makes this feature very easy to deal with. If you program in C or C++, you can simply have the API call a function that you have written whenever an enabled event occurs. In Visual Basic, the event routine of the included class module is triggered whenever an event occurs (this is similar to the Click event of a button). In either case, the event routine is passed parameters, which indicate which event occurred, and what its new value is.

Thorough documentation for the API is included with the download. Each function is documented, and occasional code snippets are included. Start your reading with the included overview and the programming guide to get familiar with the library, and then refer to the reference section when you need help with specific details.

Sample Applications

Sample applications are a good way to demonstrate some of the capabilities of the serial board while at the same time providing some guidance for programmers. We have included some sample applications with the API, which you can download. We will briefly discuss the sample done in Visual Basic. We will not repeat the source code here since it is included in the download. See Figure 3 for a screen shot of the application. We will have three operations occurring simultaneously:

1.) Poll an analog channel and graphically display the value on the screen.

2.) Count the hardware events which occur on a particular pin and display the tally on the screen.

3.) Write the hardware event tally to an output port.

You need to connect some very simple hardware to the serial board in order to use this sample application. See Figure 4 for details. Load the Visual Basic project and look at the Form_Load() procedure. Change the baud rate and serial port configuration options to match your set-up and then run the program.

Turning the potentiometer connected to Port 1 will change the size of the bar graph on the screen. At the same time, the serial board is monitoring Port 2 Bit 0 for events. When an event is detected, the event count is updated on the screen and the value is written to Port 3. If you have the LEDs connected, the count will be displayed in binary form for you to see.

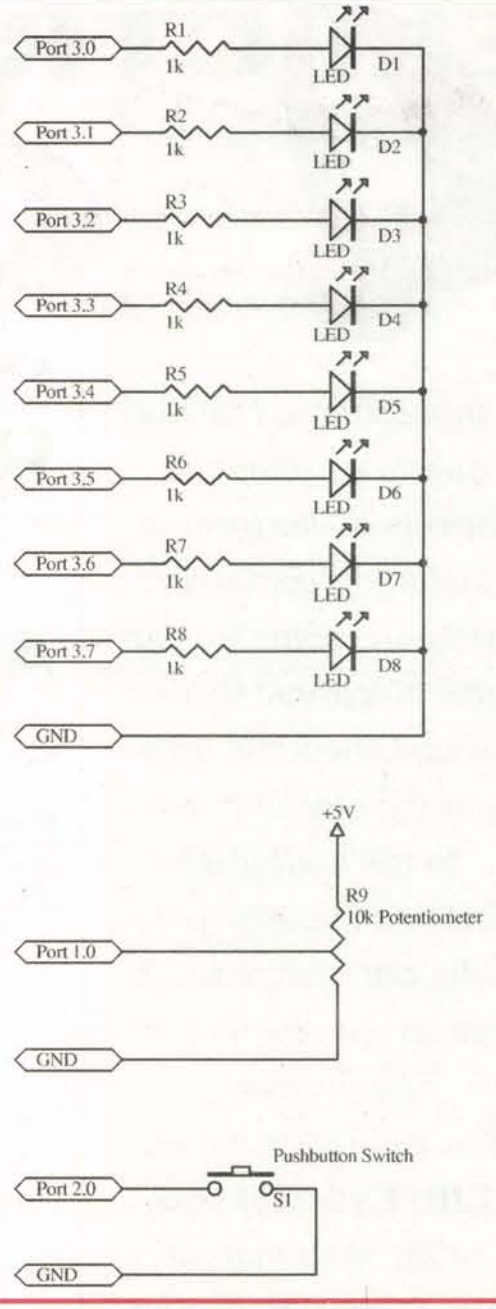
This was a very simple example, but doubtless you can think of a number of areas where these techniques could be put to use. The download also includes some sample applications written in C, as well as an all-purpose, text-based test utility available for both Linux and Windows.

Conclusion

Have any questions? Be sure to download the software package (see sidebar), as it contains the firmware, software libraries, documentation, and sample applications. Feel free to contact the authors if you have questions. The email address is serial@winfordeng.com. We are also interested in hearing about the ways you were able to use this board.

If all this is new to you, take the time to try it out. We covered a lot of material, but it's really pretty easy once you get started. Computer control is a fascinating area, and the possibilities are endless. Read a temperature sensor and graph the readings over time, or automate some part of your home. Monitor a building via the Internet. Start with something simple and work your way up if necessary. The key is to just get started. Have fun! **NV**

Figure 4: Hardware needed for the Visual Basic sample application.



Resources

Firmware, Software Library, Examples, Documentation
The files are available from two sites:
The Nuts & Volts web site:
www.nutsvolts.com
Winford Engineering:
www.winfordeng.com/serial/

Terminal Program
Teraterm is a freeware terminal program for Windows. Search for 'teraterm' on:
www.tucows.com

ELECTRONICS Q & A

With TJ Byers

In this column, I answer questions about all aspects of electronics, including computer hardware, software, circuits, electronic theory, troubleshooting, and anything else of interest to the hobbyist. Feel free to participate with your questions, as well as comments and suggestions. You can reach me at:

TJBYERS@aol.com

or by snail mail at Nuts & Volts Magazine, 430 Princeland Ct., Corona, CA 92879.

What's Up:

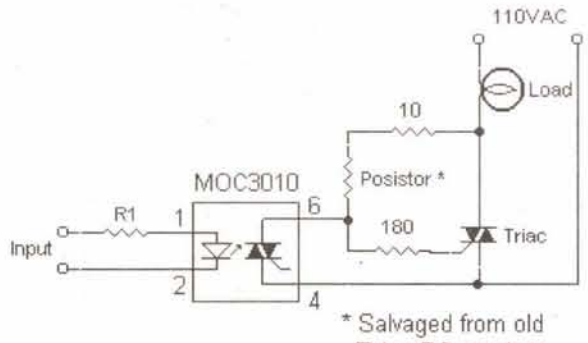
High-power lamp chaser, high-power power supply, and reverse powered triacs. Another round of NiCd/Ni-MH charging questions. Two good parts and manual search suggestions, plus a new look at our web site. Reader input on previous questions/answers, and finally, it's all happening at the zoo.

A Normally-Closed Triac

Q. I am looking for a circuit that uses a triac and a 3011 opto-coupler that acts like a normally-closed relay until the 3011 LED is energized and opens the triac's "contacts."

Neil Whittaker
via Internet

A. Actually this a is fairly easy trick if you look at it from the right perspective. You want it on when it's off and off when it's on, right? Simply short the input of the triac's gate so that it can't trigger. The hard part is to not waste a lot of power in the process. What you need to do is place a low-value resistor from the anode to the gate, then short that gate to ground when the MOC3010 comes on (note that the MOC3010, MOC3011, and MOC3012 are electrically identical except for the LED trigger current).



* Salvaged from old TV or PC monitor

This is well and good when the triac is conducting, because virtually zero power has to be dissipated by the gate resistor. But when the MOC3010 shorts out the gate, the power across the resistor jumps from nada to P = EI. Assuming the triac needs 25 mA to trigger, that means 110 volts times .025 amps equals 2.8 watts — unacceptable.

The secret is a PTC (positive temperature coefficient) thermistor, like the kind used in the degaussing coil of your TV set or PC monitor — a posistor, to be exact. When cold, they have low resistance. Short them out, though, and they get hot and reduce the current flow to almost nothing. So for a short period when the MOC3010 kicks in, there will be a minor surge of current until the posistor warms up and reduces the current flow. While posistors are easy to find and sell for less than a buck (any TV repair shop has them on hand), I suggest you cannibalize an old TV or monitor because it's free and just the right value. If you can't find one locally, the YM120D105N600 from Thermometrics (**Digi-Key, 800-344-4539; www.digikey.com**) is a good choice. When the MOC3010 short is removed, the posistor cools and returns to its low-resistance state.

Extracting Zip Files For Free

Q. I have Windows 98, but I can't expand or decompress the Easytrax.zip file that I downloaded from Protel.com. I would appreciate if you could tell me how to do it. I haven't had this computer very long, and I can't find any assistance from the Help Menu.

John Lee
via Internet

A. Most files on bulletin boards and electronic services like CompuServe and the Internet are distributed as archives. Two benefits of using archives for electronic file distribution are that only one file transfer operation (download) is required to obtain all related files, and the file transfer time is minimized because the files are compressed. Zip is the most popular archive format. To extract the individual files from a Zip file you need an unzipping software program — see the list below. A few Internet services, like AOL, will automatically unzip files after they are downloaded.

Aladdin Expander — free!
www.thefreesite.com/cgi-bin/search/hyperseek.cgi?ID=956797325

CAM Unzip — free!
camdevelopment.com/cuz.htm
www.davecentral.com/10236.html

FreeZip — free!
www.ozemail.com.au/~nulifetv/freezip

PowerArchiver 2000 — free!
www.thefreesite.com/cgi-bin/search/hyperseek.cgi?ID=956797324

PKZip — $34.00
www.pkware.com

The Unzip Wizard — shareware ($16.95)
www.pc-shareware.com/unzipwiz.htm

WinZip — $29.95
www.winzip.com

1 Click UnZip — $9.95
cmbsoftware.com/clickandunzip.htm

1 Step UnZip — $19.95
1stepunzip.com

Why Can't I Mix Ch 3 and Ch 4?

Q. With respect to the question on mixing satellite and TV in the Jan. 2001 issue, what is the downside of simply combining the channel 3 output of the satellite receiver with the TV antenna? Provided there is no local channel 3 VHF, you could still have one coax throughout the house. When you want satellite, you tune to channel 3; when you want local TV, you spin off of channel 3 and tune into channel 4, 5, 6, or whatever. If you have an X10 IR to UHF transceiver unit, you can do this from your remote. And if you have a programmable remote, you can program your satellite dish functions, too.

Derek Casari
Los Angeles, CA

A. Simply put: it creates crosstalk. The channel 3 modulator inside your DSS receiver lacks the expensive filtering of TV broadcast modulators. Consequently, the signal is "wider" than it should be and channel 3 will spill into nearby channels, including channels 2, 4, and 5. That's why you need an "agil modulator" — to move it to an area where the airwaves aren't so cramped.

A little background: When TV was "invented," no one envisioned its impact on the at-that-time movie going public, so there were but a few experimental channels allocated to the new technology. At that time everybody thought 13 channels would be more than enough. (Bad guess!) To reduce channel crosstalk, the channels were alternated so that there would never be two adjacent channels in any one broadcast region. The first TV broadcasts were B&W, mono audio. As color, Surround Sound and closed captioning came on line, greater demands were placed on the technology — yet the same old bandwidth had to handle the added information. So you can see why a sloppy DSS filter can wash out nearby channels, and why the DSS fits better in the UHF spectrum where there's more headroom.

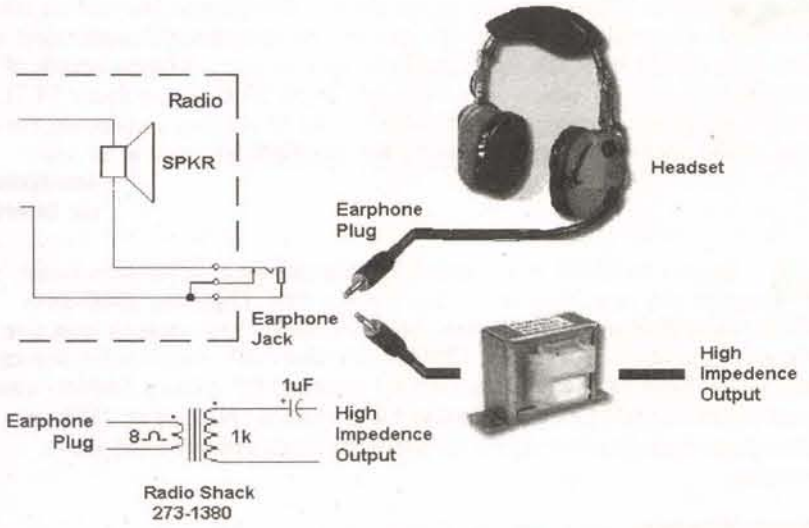
Adapt-An-Earphone Jack

Q. I have a portable clock radio that I often use for easy listening and as an audio signal source.

Unfortunately, my co-workers don't always appreciate my taste in music and the speaker volume often confuses my audio testing. Is there a way to add an earphone jack to this versatile device while turning the speaker off?

James Dayans
via Internet

A. This circuit calls for an interrupt-type earphone jack, one that breaks the speaker circuit when an external speaker or headset is plugged in. This protects your worker's ears and makes it easier to use it as a signal source without having to open the case to clip across the speaker terminals.



When used as a signal source, an audio transformer isolates the radio from the equipment under test. Notice that the transformer is reversed, with the secondary connected to the earphone jack and the input to the signal source. A 1uF cap prevents DC current from flowing through the primary winding.

Battery Charger Question

Q. I have read a number of advertisements extolling the virtues of pulse charging rechargeable batteries, like NiCd and Ni-MH. One company which makes such a claim is **Advanced Charger Technology, Inc. (800-606-6452; www.actcharge.com)**.

My question: Is there any real advantage to using a pulse charger in terms of battery life? I don't think that most proprietary chargers for heavy-use batteries such as found in, for example, portable electric drills or cell phones use pulse chargers. Therefore, I am skeptical that the benefits of pulse charging are more hype than reality. Your thoughts?

Greg Voge
via Internet

A. Many low-end battery chargers use linear chargers in a current source configuration monitored by a battery-charger IC. This method, while inexpensive, generates a lot of heat and requires charging times of up to 10 hours. In today's fast-paced world, that overnight charging time and power waste is not an option. A better way to charge a battery is to use switching modulation — commonly called pulse charging.

Using pulse charging, the heat inside the battery doesn't build up like with the linear method, which extends battery life. Moreover, because more of the charge goes into the battery, and not wasted as heat, the battery reaches full charge in a fraction of the time. Advanced Charger Technology actually pioneered a large chunk of this technology, and holds a number of patents on it. Their claim to fame is that, unlike most pulse charging methods, they don't require a trickle cycle to maintain the charge in the cells. Hype you ask? Not really, just bragging about a better mouse trap.

Slow Charging Ni-MH Batteries

Q. Is there any reason I cannot charge my 1200 mAH Ni-MH AA cells on a NiCd battery charger? I read the article "Build a Low-Cost Ni-Cad/NI-MH Battery Charger" (Jan. 2001) by Fred Blechman, which indicates you can charge Ni-MH batteries in any charger so long as you do not exceed 1/10 of the capacity and be mindful of the charge time. I have a nifty little charger about the size of an audio cassette which can charge four AA batteries at a time. The charge current is 88 mA; the batteries I want to charge are 1200 mAH. I see no reason I can't use this charger to charge my Ni-MH batteries — is there? It would make a super charger (no pun intended) to take traveling.

Don Smith K6CHS
via Internet

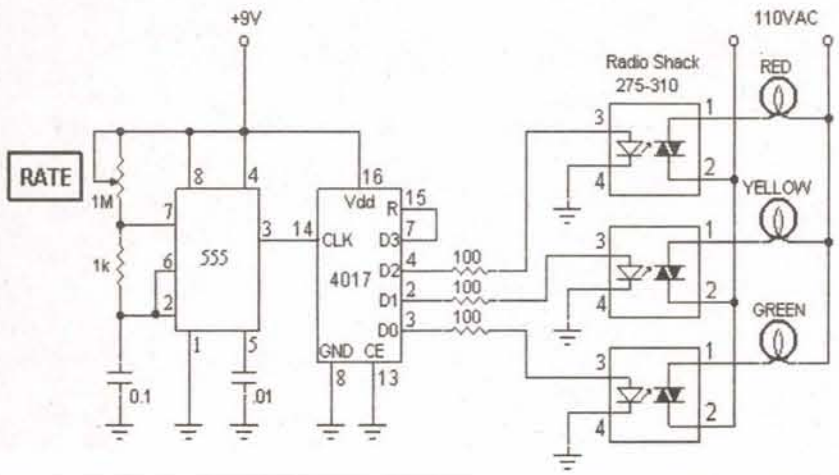
A. Ni-MH batteries can work with a slow charger/wall adapter or any charging method with a charge rate less than C/10 — 1/10 of battery capacity. In fact, Ni-MH batteries can be left on the charger indefinitely at C/10 or lower charge rates. Exceeding this charging current, or charging any Ni-MH battery at higher currents beyond its recommended charge time, can shorten its useful life. In your case, C/10 equals 120 mA, well above the capacity of an 88-mA charger. Bottom line: use it.

Go! Slow! Stop!

Q. I'd like a light chaser circuit that would mimic a traffic light, where three 150W lamps would flash in a green, yellow, red sequence. The frequency will be about 2Hz. What do you have, if anything, in your bag of tricks?

Frank Petrich
via Internet

A. Just so happens I have a very solid design that's been around for a long time, and can be found in many hobbyist kits, like the CL-1 from **Electronic Rainbow (317-291-7262; www.rainbowkits.com)**. Most circuits are designed to drive LEDs. I've modified the circuit to flash high-wattage incandescent lamps.



The front end of the circuit is straightforward, with a 555 pulse generator clocking a 4017 decade counter/divider. With each clock pulse, one of the Dx outputs goes high. Normally this would light an LED, so what I've done is use the same output to light the LED inside a solid-state relay (RadioShack 275-310). This relay uses zero-crossing triggering to reduce RFI interference and is capable of controlling lamps up to 300 watts.

Common Sense CMOS

Q. In your Dec. 2000 column you stated that an LM339 chip that you bought at RadioShack turned out to be a CMOS type. This sounds like just what I am looking for. Could you give me the designation, manufacturer, and date code of that chip? The RadioShacks in my area carry different brands of LM339, but I can't tell which ones might be CMOS. So far, I have found ST, TI, and Philips all with a designation of LM339N, and all claiming a quiescent current of 800 uA. I think I may be looking for an LP339. It's rated at 60 uA.

Anonymous
via Internet

A. Yep, it's an LP339 from Texas Instruments. National Semiconductor makes the same chip, which you can buy from **Digi-Key (800-344-4539: www.digikey.com)** in case your local RadioShack doesn't have one on the shelf. Just keep in mind that CMOS can't have ANY unconnected inputs; that's what I missed the first time when I assumed BJT (binary junction transistor) technology. BTW, if you see an NE prefix (i.e., NE555) or 7555 on chips from RadioShack, they are CMOS from TI, too, so heed the above warning.

Part Search ...

Q. I am looking for a Texas Instruments TI p47a (also labeled TI P47) transistor. I was wondering if you can find a source for this transistor?

Josh Smith
via Internet

A. The transistor's number is actually TIP47, and it's available from **Mouser Electronics (800-346-6873; www.mouser.com)** and

Future Electronics (800-655-0006; www.future-active.com). This NPN transistor (housed in a TO-220 case) has a VCEO (collector-to-emitter breakdown voltage) rating of 250 volts and a collector current of 1 amp; a suitable substitute is the NTE198.

... to Part Find

Q. I have a part that looks similar to a TO-3 transistor package but with four leads. It's labeled PIC625. I've searched Digi-Key and chipdirectory.com, and found nothing. Do you know where to find this part?

J.S. Smith
via Internet

A. Locating parts can be a nightmare, and I've done my best to point out web links to find even the most obscure and obsolete. You can find a list of the most productive sites located on our web site **(www.nutsvolts.com)** under the name PARTFIND.TXT. I located this particular device using the Google.com search engine.

Quick COMpSEEK; http://members.es.tripod.de/adm/popup/roadmap.shtml

PIC625 = SW-REG, 60V, 15A, 100kHz

Nuts & Volts Search ...

Q. Please tell me which issue you outlined a basic circuit application for a solar panel battery charger. I keep all my back-issues (for the last three years) of *Nuts & Volts*, and it would really help if there was an article or subject-referenced look-up table or an index of some sort for the various entries in both your column and others over the years. There is such a wealth of useful information that keeping track of it is mind-boggling.

Greg Roehr
via Internet

A. You'll find two versions of the solar panel battery charger in the April 1997 issue. Know the feeling of trying to remember just where and when an article or topic was published. To help you in your quest, the *Nuts & Volts* web site has a search feature that locates many past features and columns. The site is updated constantly, so check it often for new additions.

... and Manuals Found

Q. I was given a GenRad 1900A Wave Analyzer. It is in excellent condition and I would like to use it or at least understand what can I do with it. Can you help me find a manual, schematics, or anyone willing to explain how to use this beautiful instrument?

Luis Morana
Minneapolis, MN

A. An extensive list of vendors for ham radio, radio, TV, video, audio, and test equipment can be found on our web site **(www.nutsvolts.com)** under the filename MANUALS.TXT. I'm aware vendors come and go. So if you readers would be so kind as to send me additions/deletions to this file so that it's current, I'd really appreciate it. Everybody benefits from this feedback — and, hey, if it's an exceptional addition, you could get your name in print and $25.00 if it relates to a reader tip — which I haven't seen in a while. (Hint! Hint! All contributions to the Q & A column pay $25.00 if it's an original idea.)

Cool Web Sites

Watch the pandas play at the Smithsonian National Zoo; live video cams and color stills.
http://pandas.si.edu

Or watch Hua Mei and Bai Yun, San Diego Zoo's pandas, at play on their live Panda Cam
www.sandiegozoo.org/special/pandas/pandacam/index.html

Perhaps the serene underwater pictures of Monterey Bay Aquarium's Kelp Cam is more to your taste.
www.mbayaq.org/efc/efc_hp/hp_kelp_cam_live.asp

Into bugs? Check out the Insect Zoo cam at the Iowa State University Entomology Department; includes remote control camera.
http://zoocam.ent.iastate.edu

Fun zoo animals from A to Z.
www.bemboszoo.com/Bembo.swf

MAILBAG

Dear TJ:

Your May 2000 *Nuts & Volts* tach schematic did not print clearly in my copy. Is that a 10K resistor going to pin 1? And the CAL portion of the circuit

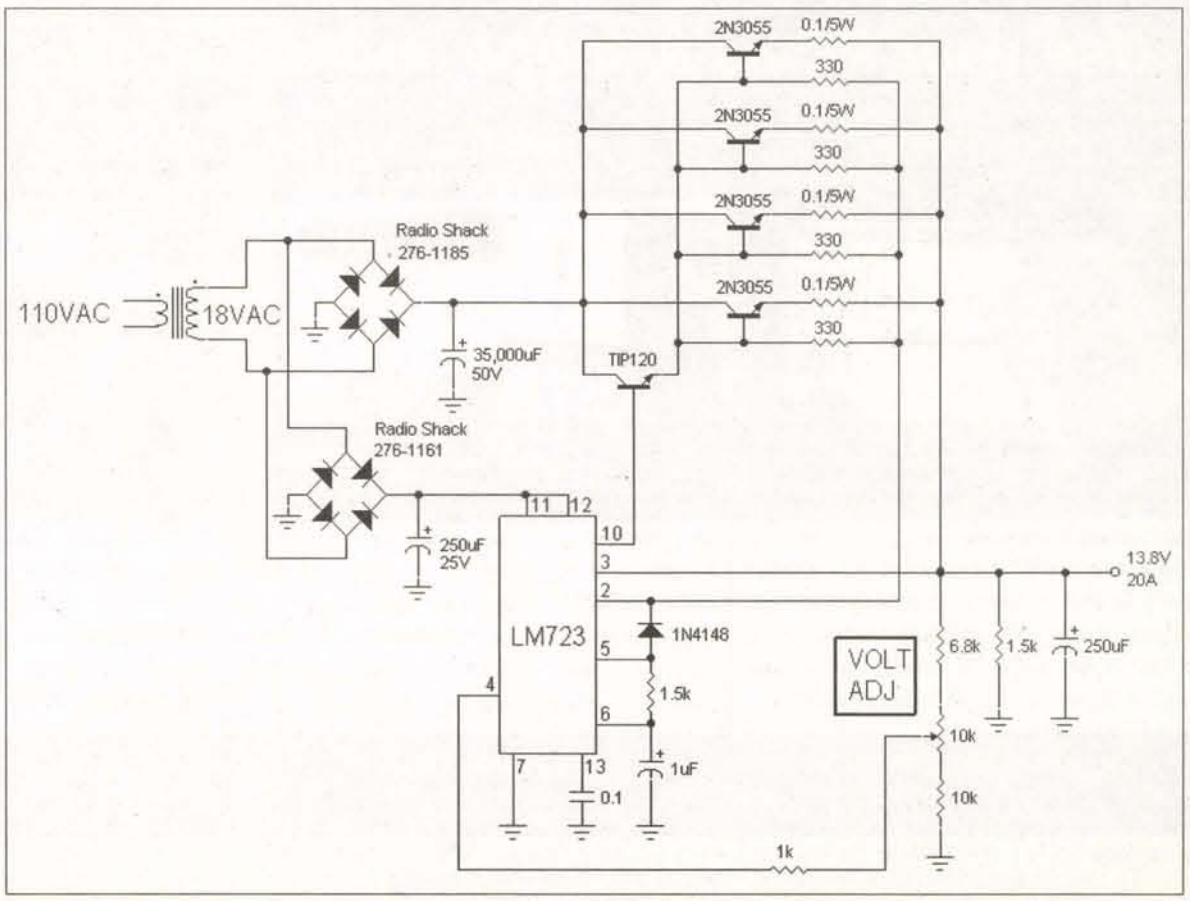
An Astron Power Supply Is Reborn

Q. In the Jan. 2000 issue you answered a question regarding a pair of burned-up power supplies, and you gave a diagram using three 2N3055 transistors with an output current of 8 amps. I'd like to build a similar power supply using four 2N3055 transistors, which I have on hand, already wired, and mounted on a large heatsink. The companion transformer outputs 16 volts AC at 35 amps. I plan on using the power supply to power a Kenwood TS-430S transceiver, which requires 13.8 volts DC at 20 amps to transmit. Can I achieve my goal with the parts I have?

D.J. Smith
via Internet

A. Operating battery-powered transceivers from a bench power supply is a common practice. Most often an Astron power supply is used because of its low cost and availability. The following circuit is based on an Astron design.

As you can see this is a bare bones unit, which I did on purpose to keep cost down. It doesn't have voltage or current meters or overcurrent protection, but both can be easily added. Although you say your transformer is rated 16 volts, I believe it's probably matched to the transistor array and will output the needed 13.8 volts DC with no problem. The output current is a conservative 20 amps, but it can easily deliver up to 25 amps when operated in the ICS — Intermittent Communication Service mode (50% duty cycle @ five minutes on and five minutes off). A cooling fan directed on the pass transistors would allow longer periods of ICS intermittent operation.



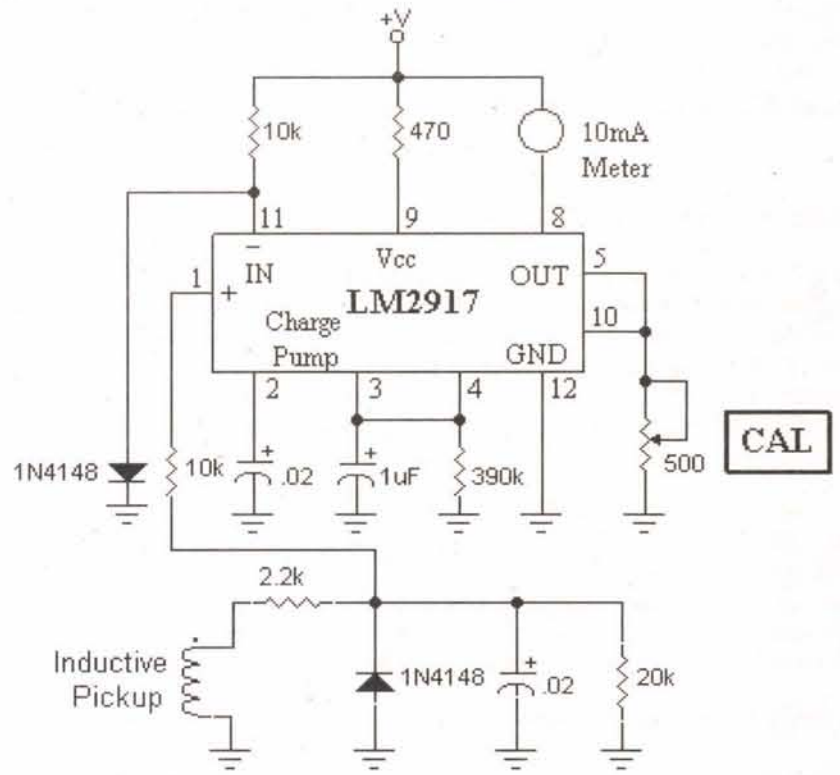
shows a 500-ohm (?) variable resistor hanging in mid-air, connected to nothing. Obviously one end goes to ground, but where does the other end connect to the chip?

Grant Fair, M.S.W., R.S.W.
Willowdale, Ontario, Canada

Response:

Sorry, sometimes during the sizing process of fitting the schematic to the page, some lines drop out. Let's try this arrangement of parts and see if it fits better — and is more readable. BTW, I've had feedback on this circuit saying it doesn't work with all magnetos. If you have a problem, feel free to get back to me and I'll see if we can do a workaround.

TJ Byers
Q & A Editor



Dear TJ:

I would like to would point out an error relating to the question regarding the use of the parallel port to turn on and off a tape recorder. The values in your "OUT" statements toward the end of the response would NOT turn on individual bits as you propose, but rather set bits in the binary representation of the number in the OUT command. I'm sure you intended to put in:

Data Line	Instruction for Logic "1" Out
All LOW	OUT &H0378, 0
D0	OUT &H0378, 1
D1	OUT &H0378, 2
D2	OUT &H0378, 4
D3	OUT &H0378, 8
D4	OUT &H0378, 16
D5	OUT &H0378, 32
D6	OUT &H0378, 64
D7	OUT &H0378, 128
All HIGH	OUT &H0378, 255

It would be worth mentioning that you could use binary arithmetic "and" / "or" statements to control individual lines without affecting the state of the other lines, and that the parallel port address could also be &h278 or in really unique cases &h3BC — if memory serves.

Steve Jones
via Internet

SIGNAL GENERATORS

FLUKE 6060A Synthesized Signal Gen., 0.1-1050 MHz, 10 Hz res. $1,500.00
FLUKE 6060B/AK Synthesized Signal Gen., 0.1-1050 MHz, 10 Hz res. $1,900.00
GIGATRONICS 600/6-12 Synthesized Source, 6-12 GHz, 1 MHz res., GPIB $1,800.00
GIGATRONICS 6000/8-16 Synthesized CW Gen., 8-16 GHz, 1 MHz res., +10 dBm $2,250.00
GIGATRONICS 875/50 Levelled Multiplier, x4, 50.0-75.0 GHz output, -3 dBm $2,500.00
GIGATRONICS 900/2-8 Synthesized Signal/Sweep Gen., 2-8 GHz, 1 MHz res.,GPIB $2,000.00
HP 11707A Test Plug-in for HP 8660 series $500.00
HP 11720A Pulse Modulator, 2-18 GHz, 80 dB on/off ratio $450.00
HP 3335A-001 Synthesizer/ Level Gen., 200 Hz-81 MHz, -87 to +13 dBm $3,500.00
HP 8656A-001 Signal Generator, 0.1-990 MHz, 100 Hz res., HPIB, OCXO $1,600.00
HP 8657A-002 Signal Generator, 0.1-1040 MHz, 10 Hz res., HPIB $2,750.00
HP 8660C/86603A/86633B Synthesized Signal Generator, 1-2600 MHz, AM, FM $3,250.00
HP 8671A Synthesized CW Gen., 2-6 GHz, 1 kHz res., +8 dBm $2,750.00
HP 8672A Synthesized Signal Generator, 2-18 GHz, +3 dBm output $4,500.00
HP 8673H-212 Synthesized Signal Generator, 2.0-12.4 GHz, 1 kHz res. $8,750.00
HP 8684B Signal Generator, 5.4-12.5 GHz, AM/ WBFM/ Pulse $3,000.00
HP 8684D Signal Generator, 5.4-18.0 GHz, AM/ WBFM/ Pulse $3,750.00
WAVETEK 952 Signal Generator, 1-4 GHz, +10 dBm, AM, FM $750.00
WAVETEK 954 Signal Generator, 3.7-7.6 GHz, +7 dBm, AM, FM $750.00
WAVETEK 957 Signal Generator, 12-18 GHz, +7 dBm, AM, FM $750.00

SWEEP GENERATORS

HP 8350B/83522A Sweep Oscillator, 10-2400 MHz, +13 dBm levelled $3,900.00
HP 8350B/83540A-002,004 Sweep Oscillator, 2.0-8.4 GHz, 70 dB step attenuator $3,900.00
HP 8350B/83545A-002 Sweep Oscillator, 5.9-12.4 GHz, 70 dB step attenuator $3,900.00
HP 8350B/83590A Sweep Generator, 2-20 GHz, +10 dBm levelled $6,500.00
HP 83570A RF Plug-in, 18.0-26.5 GHz, +10 dBm levelled $6,000.00
HP 8601A Generator/Sweeper, 0.1-110 MHz, +20 dBm levelled $400.00
HP 8620C Sweep Oscillator Frame $550.00
HP 86222B-002 RF Plug-in, 10-2400 MHz, +13 dBm lvld., 70 dB step att. $1,250.00
HP 86222B-E69/8620C Sweep Oscillator, 0.01-2 GHz & 2-4 GHz, +10 dBm, w/frame $1,500.00
HP 86235A-001 RF Plug-in, 1.7-4.3 GHz, +16 dBm levelled $400.00
HP 86241A-001 RF Plug-in, 3.2-6.5 GHz, +8 dBm levelled $300.00
HP 86260A-H04 RF Plug-in, 10.0-15.0 GHz, +10 dBm unlevelled $400.00
HP 86290A RF Plug-in, 2.0-18.0 GHz, +7 dBm levelled $1,200.00
HP 86290B RF Plug-in, 2.0-18.6 GHz, +10 dBm levelled $1,650.00
HP 86290C RF Plug-in, 2.0-18.6 GHz, +13 dBm levelled $1,850.00
WAVETEK 2001 Sweep Generator, 1-1400 MHz, +10 dBm, 70 dB step atten. $900.00
WAVETEK 2002A Sweep Generator, 1-2500 MHz, +10 dBm, 70 dB step atten. $1,200.00
WAVETEK 962 Sweep Generator, 1.0-4.0 GHz, markers, +12 dBm unlvld. $950.00
WILTRON 6717B-20 Freq. Synth./ Sweeper, 10 MHz-8.4 GHz, +13 dBm, AM, FM $6,500.00

POWER METERS

BOONTON 42B/41-4E Analog Power Meter, with 1 MHz-18 GHz sensor $450.00
HP 432A/478A Power Meter, -30 to +10 dBm, 10 MHz-10 GHz $300.00
HP 435B/8481A Power Meter, -30 to +20 dBm, 10 MHz-18 GHz $900.00
HP 435B/8482B Power Meter, 0 to +43 dBm, 100 kHz-4.2 GHz $1,500.00
HP 436A-022/8481A Power Meter, -30 to +20 dBm, 10 MHz-18 GHz, HPIB $1,200.00
HP 436A-022/8484A Power Meter, -70 to -20 dBm, 10 MHz-18 GHz, HPIB $1,200.00
HP Q8486A Power Sensor, 33.0-50.0 GHz, WR22, for 435/6/7/8 ..... $1,500.00
HP R8486A WR28 Power Sensor, 26.5-40 GHz, for HP 435/6/7/8 ..... $1,500.00

RF MILLIVOLTMETERS

BOONTON 92C RF Millivoltmeter, 3 mV-3 V f.s., 10 kHz-1.2 GHz $500.00
RACAL-DANA 9303 RF Millivoltmeter, 10 kHz-2 GHz, -70 to +20 dBm $750.00

AMPLIFIERS, MISCELLANEOUS

AMPLIFIER RESEARCH 4W1000 Amplifier, 40 dB gain, 4 Watts, 1-1000 MHz $950.00
BOONTON 82AD Modulation Meter, AM / FM, 10-1200 MHz $650.00
C.P.I. VZC6961K1 TWT Amplifier, 35 dB gain, 4-8 GHz, 20 Watts $3,500.00
ENI 310L Amplifier, 50 dB gain, 250 kHz-110 MHz, 10 Watts output $1,200.00
HP 11729B-003 Carrier Noise Test Set, 5 MHz-3.2 GHz $2,250.00
HP 415E SWR Meter $200.00
HP 8347A Amplifier, 25 dB gain, 100 kHz-3 GHz, +22 dBm $2,900.00
HP 8406A Comb Generator, 1/ 10/ 100 MHz increments, to 5 GHz $500.00
HP 8447A Amplifier, 20 dB, 0.1-400 MHz, 5 dB NF, +6 dBm output $375.00
HP 8447E Amplifier, 22 dB, 0.1-1300 MHz, +13 dBm output $750.00
HP 8447F-H64 Dual Amp., 9 kHz-50 MHz 28 dB & 0.1-1300 MHz 25 dB $900.00
HP 8901A Modulation Analyzer, 150 kHz-1300 MHz $1,500.00
HP 8901B-1,2,3 Modulation An., 0.15-1300 MHz, rear input, OCXO, ext.LO $2,000.00
HUGHES 1177H01F000 TWT Amplifier, >30 dB gain, 2-4 GHz, 10 Watts output $1,750.00
HUGHES 1177H10F000 TWT Amplifier, >30 dB gain, 1.4-2.4 GHz, 20 Watts $2,500.00
HUGHES 8010H13F000 TWT Amplifier, >30 dB gain, 3-8 GHz, 10 Watts $2,500.00
RF POWER LABS ML50 Amplifier, 2-30 MHz, 47 dB gain, 50 Watts, metered, 28V $275.00
ROHDE & SCHWARTZ ESH2 Test Receiver, 9 kHz-30 MHz $3,750.00

COAXIAL & WAVEGUIDE

AEROWAVE 28-3000/10 WR28 Directional Coupler, 10 dB, 26.5-40 GHz $300.00
AMERICAN NUCLEONICS AM-432 Cavity Backed Spiral Antenna,LHC, 2-18 GHz,TNC(f) *NEW* $95.00
AVANTEK AMT-400X2 WR28 Active Doubler, +10 dBm in/ +10 dBm out 26-40 GHz $450.00
BIRD 6735-300 1 kW Load, 25-1000 MHz, LC(f), with wattmeter $650.00
BIRD 8201 500 Watt Oil Dielectric Load, DC-2.5 GHz, N(f) $350.00
FXR/MICROLAB SL-03N Stub Stretcher, 0.3-6.0 GHz, 100 Watts max., N(m/f) $75.00
GR 874-LTL Constant Impedance Trombone Line, 0-44 cm, DC-2 GHz $400.00
HP 11590A-001 Bias Network, 1.0-18.0 GHz, APC7 ..... $450.00
HP 11636A 2-Way Power Divider, DC-18 GHz, N(m/f/f) $300.00
HP 11691D-001 Directional Coupler, 22 dB, 2-18 GHz, N(f)-all ports $450.00
HP 11692D Dual Directional Coupler, 22 dB, 2-18 GHz $800.00
HP 33321K Programmable Step Atten., 0-70 dB, DC-26.5 GHz, 3.5mm $475.00
HP 33327L-006 Programmable Step Attenuator, 0-70 dB, DC-40 GHz, 2.9mm $1,000.00
HP 778D-011 Dual Dir. Coupler, 20 dB, 100-2000 MHz, APC7 test port $450.00
HP 779D Directional Coupler, 20 dB, 1.7-12.4 GHz $400.00
HP 8431A 2-4 GHz Band Pass Filter, N(m/f) $150.00
HP 8494G-002 Programmable Step Attenuator, 0-11 dB, DC-4 GHz, SMA $350.00
HP 87300C-020 Directional Coupler, 20 dB, 1.0-26.5 GHz, 3.5mm $475.00
HP K422A WR42 Flat Broadband Detector, 18.0-26.5 GHz $350.00
HP K532A WR42 Frequency Meter, 18.0-26.5 GHz $450.00
HP K752A WR42 Directional Coupler, 3 dB, 18.0-26.5 GHz $450.00
HP K752C WR42 Directional Coupler, 10 dB, 18.0-26.5 GHz $450.00
HP K752D WR42 Directional Coupler, 20 dB, 18.0-26.5 GHz $450.00
HP K870A WR42 Slide Screw Tuner, 18.0-26.5 GHz $275.00
HP K914B WR42 Moving Load, 18.0-26.5 GHz $300.00
HP Q752D WR22 Directional Coupler, 20 dB, 33-50 GHz $650.00
HP R422A WR28 Crystal Detector, 26.5-40 GHz $400.00
HP R752D WR28 Directional Coupler, 20 dB, 26.5-40 GHz $450.00
HP R914B WR28 Moving Load, 26.5-40 GHz $250.00
HP V365A WR15 Isolator, 25 dB, 50-75 GHz $750.00
HP V752D WR15 Directional Coupler, 20 dB, 50-75 GHz $650.00
HP X870A WR90 Slide Screw Tuner $150.00
HUGHES 45322H-1110/1120 WR22 Directional Couplers, 10 or 20 dB, 33-50 GHz $350.00
HUGHES 45712H-1000 WR22 Frequency Meter, 33-50 GHz $750.00
HUGHES 45714H-1000 WR15 Frequency Meter, 50-75 GHz $900.00
HUGHES 45721H-2000 WR28 Direct Reading Attenuator, 0-50 dB, 26.5-40 GHz $1,000.00
HUGHES 45722H-1000 WR22 Direct Reading Attenuator, 0-50 dB, 33-50 GHz $1,000.00
HUGHES 45724H-1000 WR15 Direct Reading Attenuator, 0-50 dB, 50-75 GHz $1,000.00
HUGHES 45732H-1200 WR22 Level Set Attenuator, 0-25 dB, 33-50 GHz $250.00
HUGHES 45752H-1000 WR22 Direct Reading Phase Shifter, 0-360 deg.,33-50 GHz $1,400.00
HUGHES 45772H-1100 WR22 Thermistor Mount, -20 to +10 dBm, 33-50 GHz $400.00
HUGHES 45773H-1100 WR19 Thermistor Mount, -20 to +10 dBm, 40-60 GHz $650.00
HUGHES 45774H-1100 WR15 Thermistor Mount, -20 to +10 dBm, 50-75 GHz $750.00
HUGHES 47316H-1111 WR10 Tuneable Detector, 75-110 GHz, positive polarity $600.00
HUGHES 47741H-2310 WR28 Phase Locked Gunn Osc., 32.000 GHz, +18 dBm $2,000.00
HUGHES 47742H-1210 WR22 Phase Locked Gunn Osc., 42.000 GHz, +18 dBm $2,750.00
KRYTAR 201020010 Directional Detector, 1-20 GHz, SMA(f/f)/SMC $200.00
KRYTAR 2616S Directional Detector, 1.7-26.5 GHz, K(f/m)/SMC $200.00
M/A-COM 3-19-300/10 WR19 Directional Coupler, 10 dB, 40-60 GHz $450.00
MICA C-121S06 Circulator, 17.5-24.5 GHz, SMA(f/m/m) $75.00
NARDA 3000-SERIES Directional Couplers $150.00
NARDA 3020A Bi-Directional Coupler, 50-1000 MHz, N $500.00
NARDA 3024 Bi-Directional Coupler, 20 dB, 4-8 GHz $375.00
NARDA 3090-SERIES Precision High Directivity Couplers $225.00
NARDA 368BNM Coaxial High Power Load, 500 Watts, 2.0-18 GHz, N(m) $500.00
NARDA 3752 Coaxial Phase Shifter, 0-180 deg./GHz, 1-5 GHz $1,000.00
NARDA 3753B Coaxial Phase Shifter, 0-55 deg./GHz, 3.5-12.4 GHz $1,000.00
NARDA 4000-SERIES SMA Miniature Directional Couplers $75.00
NARDA 4247-20 Directional Coupler, 20 dB, 6.0-26.5 GHz, 3.5mm(f) $200.00
NARDA 4247B-10 Directional Coupler, 10 dB, 6.0-26.5 GHz, 3.5mm(f) $200.00
NARDA 5070-SERIES Precision Reflectometer Couplers $300.00
NARDA 562 DC Block, 10 MHz-12.4 GHz, 100 V max., N(m/f) $65.00
NARDA 765-10 10 dB Attenuator, 50 Watts, DC-5 GHz, N(m/f) $165.00
NARDA 791FM Variable Attenuator, 0-37 dB, 2.0-12.4 GHz $600.00
NARDA 792FF Variable Attenuator, 0-20 dB, 2.0-12.4 GHz $375.00
NARDA 793FM Direct Reading Variable Attenuator, 0-20 dB, 4-8 GHz $225.00
NARDA 794FM Direct Reading Variable Attenuator, 0-40 dB, 4-8 GHz $375.00
OMNI-SPECTRA 2085-6010-00 Crystal Detector, 1-18 GHz, negative polarity, SMA(m/f) $50.00
PAMTECH KYG1014 WR42 Junction Circulator, 18.0-26.5 GHz $250.00
SONOMA SCIENTIFIC 21A3 WR42 Circulator, 20 dB, 20.6-24.8 GHz $75.00
TEKTRONIX 2701 Step Attenuator, 0-79 dB, DC-1 GHz, AC or DC coupled $175.00
TRG B510 WR22 Direct Reading Attenuator, 0-50 dB, 33-50 GHz $900.00
TRG V510 WR15 Direct Reading Attenuator, 0-50 dB, 50-75 GHz $900.00
TRG V551 WR15 Frequency Meter, 50-75 GHz $600.00
TRG W510 WR10 Direct Reading Attenuator, 0-50 dB, 75-110 GHz $1,000.00
TRG W551 WR10 Frequency Meter, 75-110 GHz $750.00
WAVELINE 100080 WR28 Terminated Crossguide Coupler, 30 dB $200.00
WEINSCHEL 150-110 Programmable Step Attenuator, 0-110 dB, DC-18 GHz, SMA $450.00
WEINSCHEL DS109 Double Stub Tuner, 1-13 GHz, N(m/f) $150.00
WEINSCHEL DS109LL Double Stub Tuner, 0.2-2.0 GHz, N(m/f) $150.00

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HP 4935A Transmission Impairment Measuring Set $600.00
HP 59401A HPIB Bus Analyzer $375.00
MICRODYNE 1200MR 215-320 MHz Telemetry Receiver, PSK demodulation $450.00
TEK 1411R PAL Gen.,w/SPG12 sync;TSG11 color bars;TSG13 linearity $750.00
TEK 1411R PAL Test Gen., w/SPG12,TSG11,TSG13, TSG15,TSG16 ..... $1,000.00
TEK 1411R PAL Test Gen., w/SPG12,TSG11,TSG12, TSG13,TSG15,TSG16 ..... $1,100.00
TEK 1411R-opt.04 PAL Test Gen.,w/ SPG12,TSG11,TSP11,TSG13,TSG15,TSG16 ..... $1,400.00
TEK 147A NTSC Test Signal Generator, with noise test signal $800.00
TEK 148 PAL Insertion Test Signal Generator $700.00
TEK 520A NTSC Vectorscope $750.00
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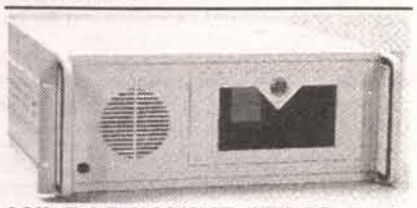

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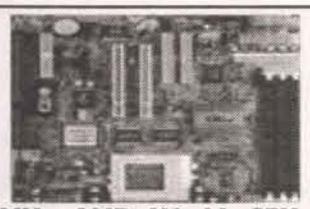

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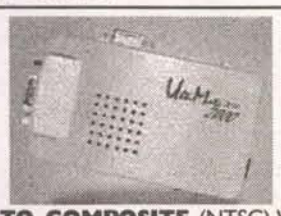

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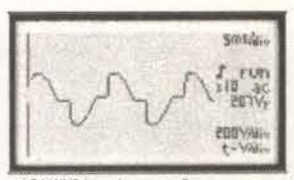
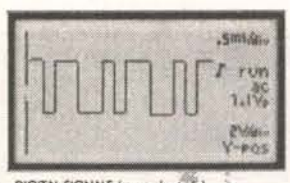
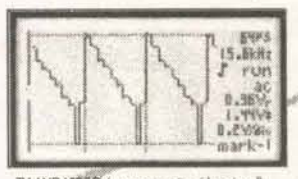


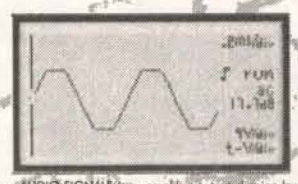
AC MAINS (e.g. phase control)



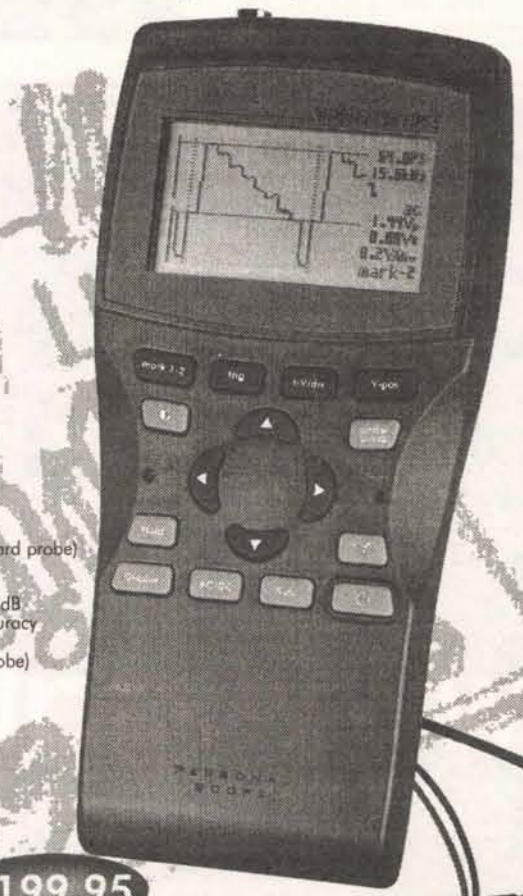
DIGITAL SIGNALS (e.g. pulse train)



TV AND VIDEO (e.g. composite video signal)



AUDIO SIGNALS (e.g. amplifier output clipping level)



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- Input amplifier bandwidth: 1MHz (-3dB at 1V/div setting) 1Mohm //20pF (standard probe)
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- LCD Graphics: 64 x 128pixels
- dBm measurements: From -73dB tot +40dB (up to 60dB with X10 probe) ±0.5dB
- True rms AC measurement: 0.1mV to 80V (400Vrms with X10 probe) 2.5% accuracy
- Time base: 20s to 2µs / div in 22 steps
- Input sensitivity range: 5mV to 20V/div in 12 steps (up to 200V/div with X10 probe)
- Supply voltage: 9VDC / min 300mA adapter
- Batteries (in option): Alkaline type AA (5 pcs required)
  NiCd/NiMH rechargeable
- Battery life: Up to 20 hours with Alkaline batteries
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- Adaptor for 110VAC: P5905USA

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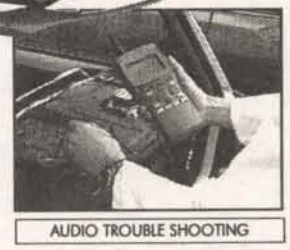

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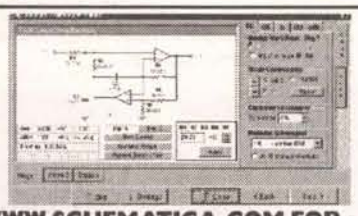

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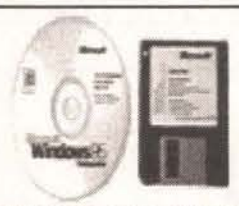

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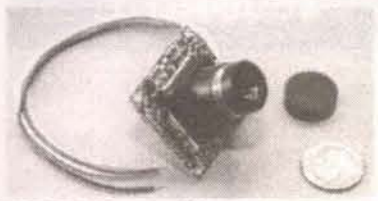

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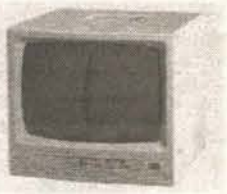

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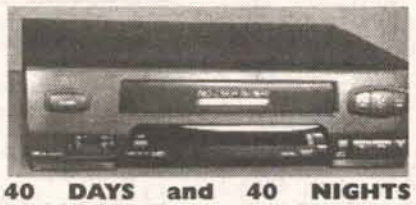

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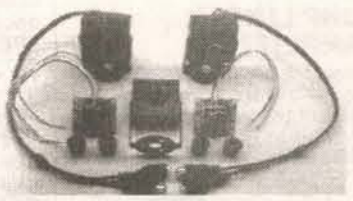

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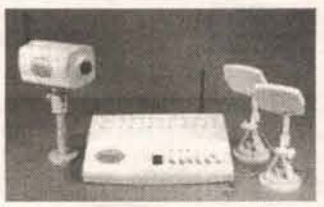

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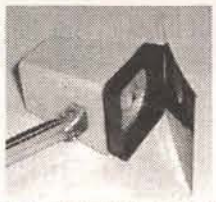

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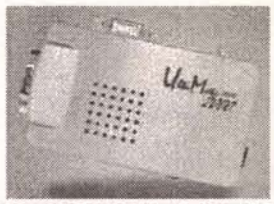

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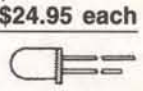

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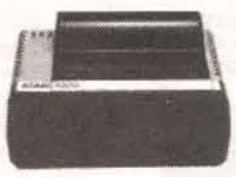

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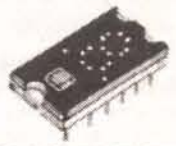

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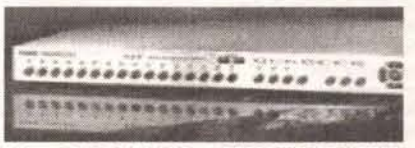

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Continued on page 56

Circle #36 on the Reader Service Card.

OOPics Get the Message

by Michael Dennis

Extending the pressroom data collector

In my last article for *Nuts & Volts*, I discussed a data collection network that used the Savage Innovations OOPic to track events in our pressroom. One of the planned extensions to that system was remote operator notification.

Our pressroom is big — 200 feet long and 60 feet wide. A press operator might be anywhere in the building, but needs to react to a press stoppage in a timely fashion. This suggests that we need to wire the operator and use a radio link to transmit press status.

We need to stay away from high power RF on this project, since our neighbors include a pair of cell phone towers and a helicopter landing pad.

My MUST HAVE list:

- No wires
- No interference outside the shop
- Compact
- Rechargeable
- Inexpensive

OOPic to the rescue, again

The OOPic provides a PIC on a handy-sized interface board, consumes little power, and has great support for LCD modules. Since it already is built into my pressroom for data collection, it was a natural choice for this part of the project.

Virtual circuits make the code "hands off." The OOPic's object-oriented compiler allows the construction of virtual circuits that behave as hard-wired electronic components. Once a circuit is set up, it runs in the background, allowing the OOPic to service other code. In this project, there is no "other code;" everything is handled by the virtual circuits.

Rapid RF development with pre-engineered AM circuits

I'm not an electrical engineer. I don't want to struggle with FCC certification of my design. And transmitter-receiver circuits are cheap these days. So it was a simple matter of choosing one. I selected the eight-bit TWS from Reynolds Electronics, since they offered a kit of all the major components for about $20.00.

The kit is built around a Holtek encoder/decoder chip set. These ICs were designed for garage door openers and security systems. On the HT 640 encoder, a set of pins takes eight bits of data and formats it for transmission on one end of the link.

On the other end, an HT 648L decoder converts the data back to eight bits and presents it on eight output pins. An additional 10 pins are available to set an address. The decoder ignores data that does not match its address. A strobe indicates that data has been received.

Some friendly advice from Reynolds on FCC regulations:

These RF modules do not require licensing when used in accordance with low power devices used for remote control applications per Title 46, Section 15 of FCC Rules and Regulations. There are, however, some limitations in the United States with regard to continuous transmissions. It is the responsibility of the end-user of these devices to review this title section prior to operating these units. These mod-

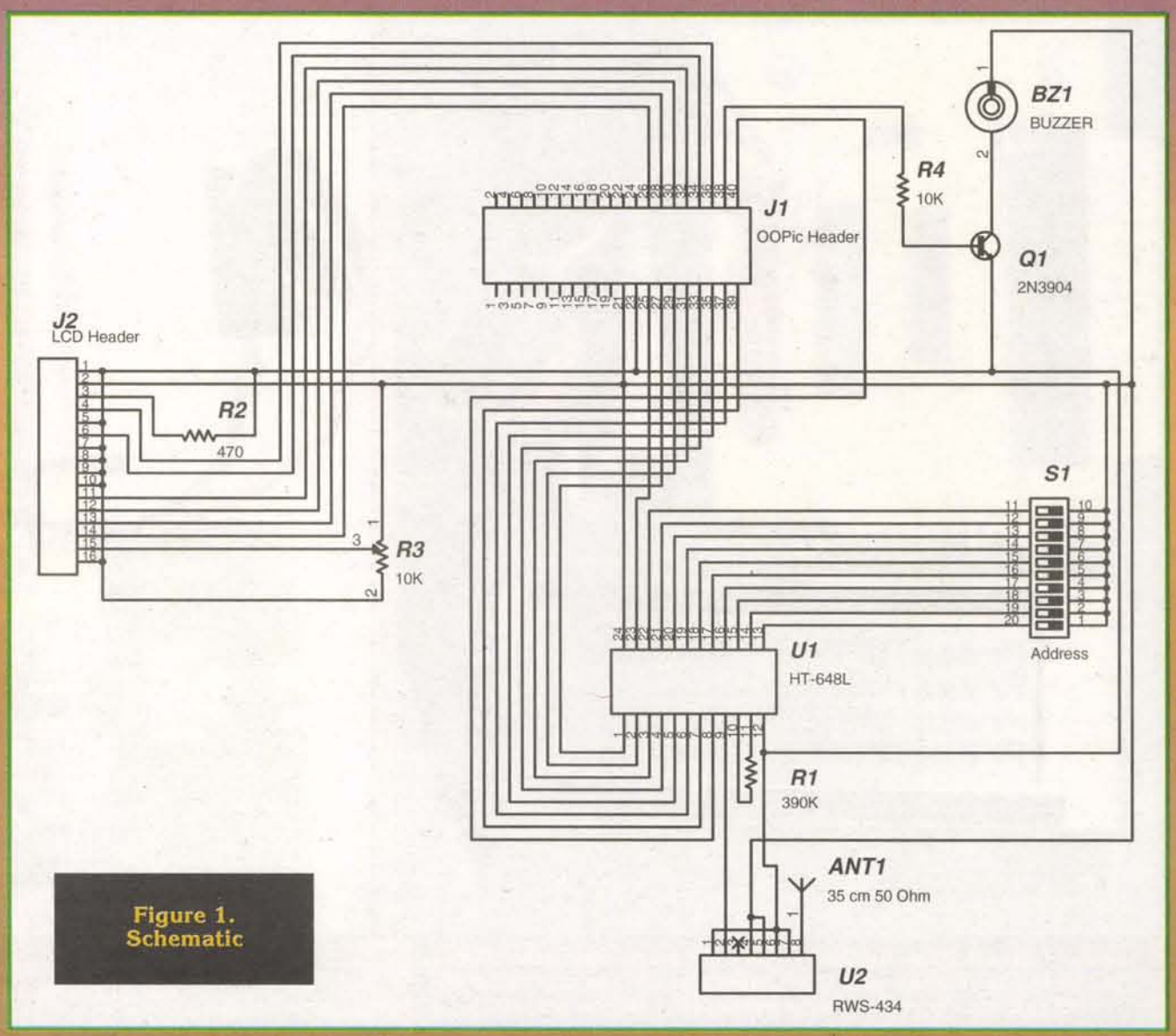


Figure 1. Schematic

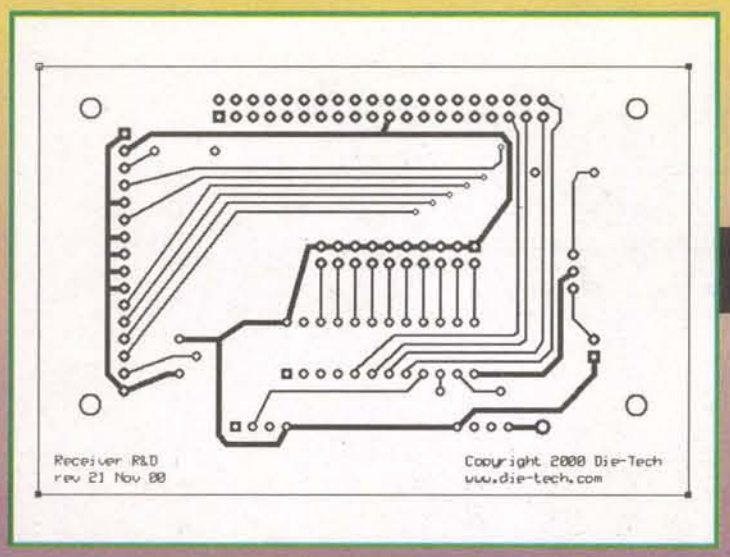
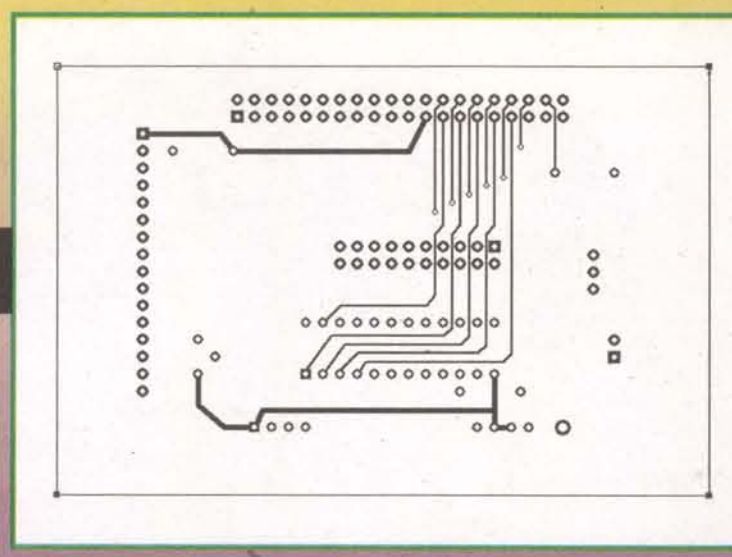


Figure 2. Plot
(actual size 3.6" x 2.5")



ules are not FCC approved, but have been designed to comply with FCC Part 15 Rules and Regulations. They are not in a finished product form, and are strictly intended for experimental/educational purposes only. If you plan to use these modules in a finished product in a non-experimental capacity, the module must be designed into the product, and the finished product submitted to the FCC for approval.

Putting it together

The schematic is shown in Figure 1. A suitable antenna feeds the RF module. The binary data pin is connected to the data input of the HT-648L. The eight data out pins of the HT are connected to the OOPic I/O header.

Since an LCD would be normal and expected for this kind of project, I included the circuitry for a Hitachi-style interface. This includes two pins for back lighting and the pads for a pot to adjust brightness.

A set of optional jumpers or dip switches lets the board be addressed. The design allows a message to be sent to just those pagers with matching codes. This could come in handy if, for example, I want to page maintenance instead of the operator.

Rounding out the options, I included traces for a buzzer circuit. An inverting transistor goes high when the OOPic pulls its output low. This transistor then switches a piezo buzzer. In the code, this is linked to the Data Ready pin of the HT 648L.

Figure 2 shows the board plot. The size of the board was dictated by PCB Express — they supply three proto boards for $59.00 if you use their router and keep the board size to 3.8 x 2.5 inches. The size is close enough to the OOPic footprint that I punched holes to allow the boards to stack. Figures 3, 4, and 5 show an assembled stack.

The enclosures hadn't arrived at the time I wrote this article. I plan to use a clamshell blister pack for the enclosure, as shown in Figure 6. They cost about 10 cents apiece and being made of clear PVC require no machining to make the LCD visible. A clip lets the operator wear it on his/her belt, shown in Figure 7. The downside is that they sell in minimum

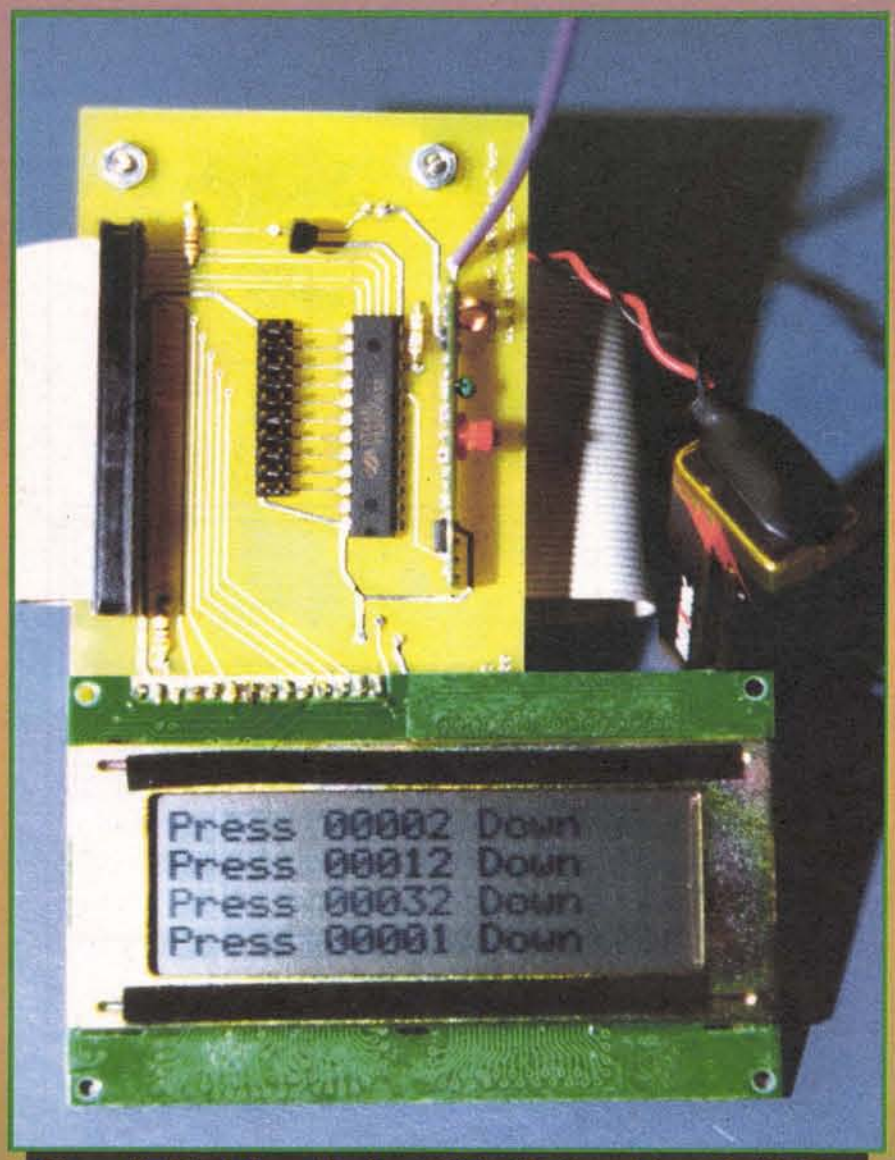


Figure 3. Stack from the front. Note the transistor substitution in the buzzer circuit, and the jumpers where the dip switches should be. Never let parts availability stop a project!

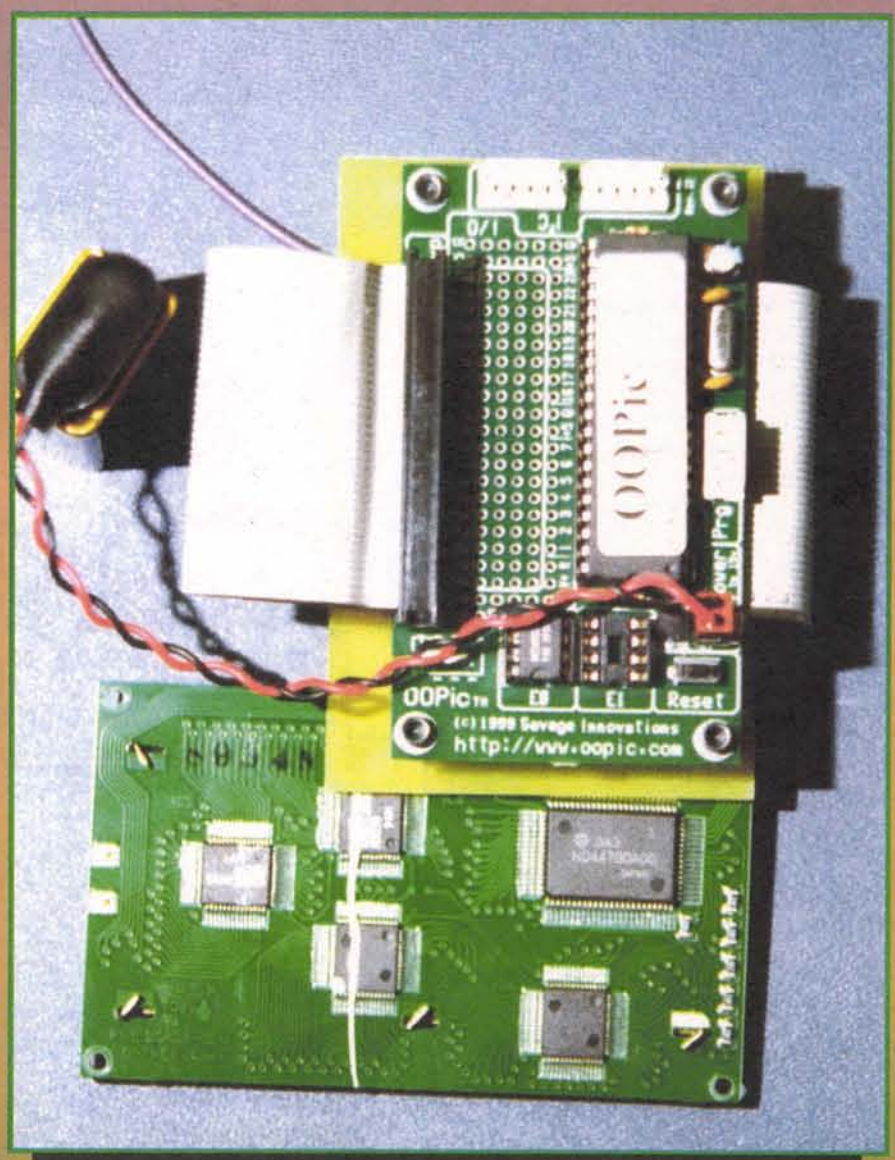


Figure 4. The back of the stack. The wire running out of the picture is the antenna.

Parts List

OOPic
Savage Innovations
www.oopic.com

8-Bit TWS, a kit of the RF parts, including:
- TWS-434 Transmitter
- RWS-434 Receiver
- Holtek HT 640 Encoder
- Holtek HT 648L Decoder
- Resistor for the oscillator
- Application notes

Reynolds Electronics
633 North 8th Street
Canon City, CO 81212
719-269-3469
www.rentron.com

Optrex 4 X 20 LCD
DMC20434-CEM

See their ad on Page 59!

All Electronics
www.allelectronics.com
P.O. Box 567
Van Nuys, CA 91408-0567
Orders: 800-826-5432
Cat #LCD-46

Pin Headers, Sockets, Resistors

See their ad on Page 55!

Mouser Electronics
www.mouser.com
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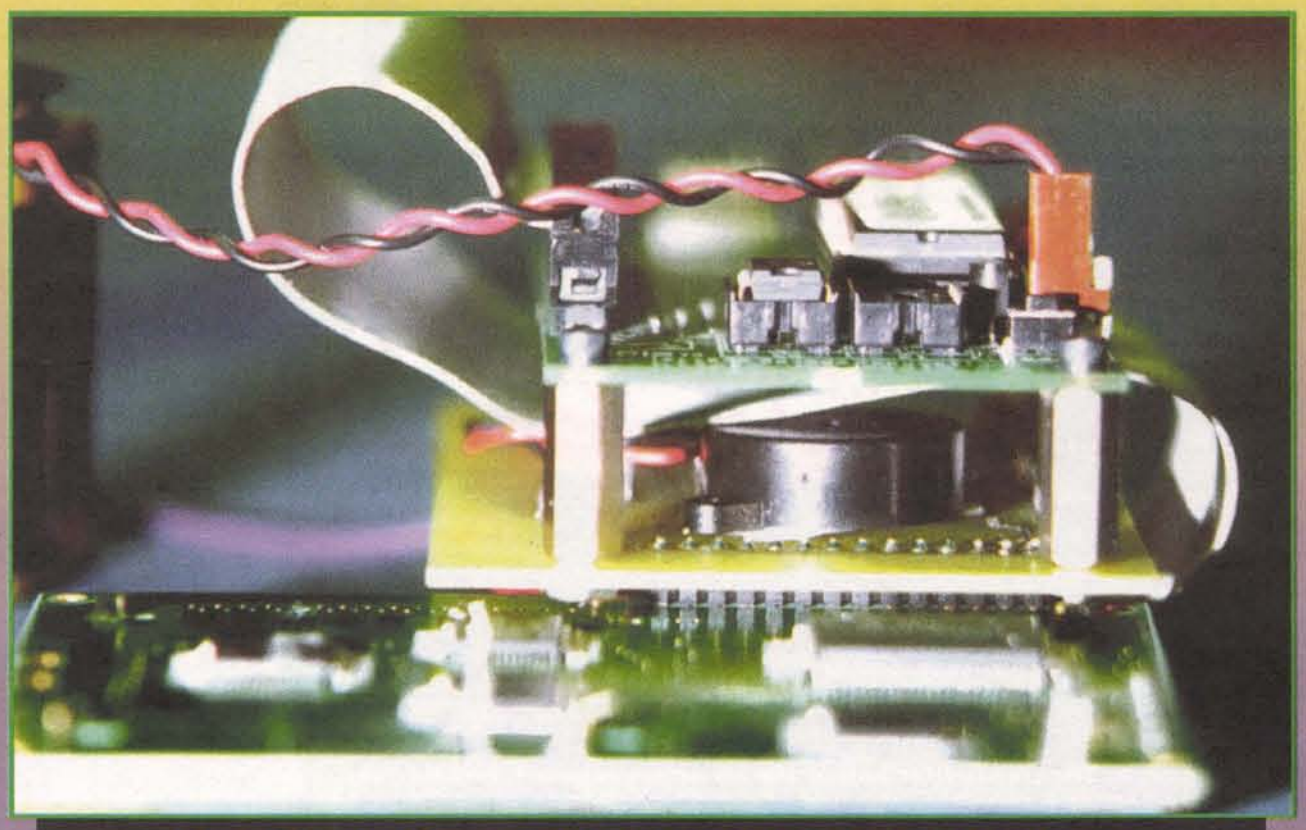


Figure 5. The stack from the side. The large black object is a piezo buzzer.

quantities of 1,000. Still I could throw most of them out and it would cost less than my machine shop cutting LCD windows at $45.00 an hour.

I plan to use rechargeable Nickel Metal Hydride batteries made by Rayovac for this project, since it's easier to replace batteries than to cradle the whole pager. Plus, I didn't have to build a charger circuit — their RS9 unit handles recharging.

Coding the OOPic

Objects need to be declared before they can be used. For this project, we need to input eight lines of data when the Data Ready line is triggered by the decoder chip. The routine Scan is declared as an event handler, so that the virtual circuit can trigger it automatically. An oGate object ties the Data Ready signal to the event.

```
'For the Scanner
Dim Msg as New oDio8        'Object is an 8-bit I/O; Message
                            'from decoder
Dim DR as New oDio1         'Object is a single-bit I/O;
                            'Data Ready from decoder
Dim Buzz As New oDio1       'Object is a single-bit I/O;
                            'Buzzer
Dim Scan As New oEvent      'Object is event handler
Dim LG As New oGate         'Object is gate
```

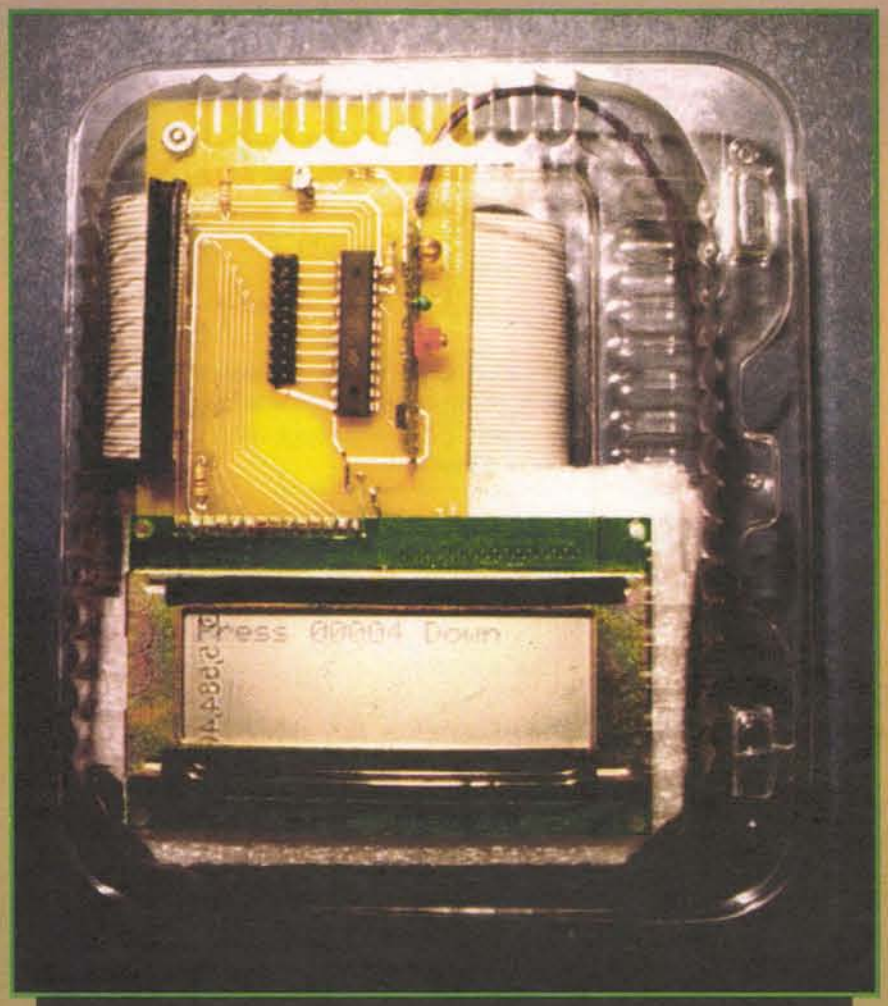


Figure 6. The finished project in a clamshell case.

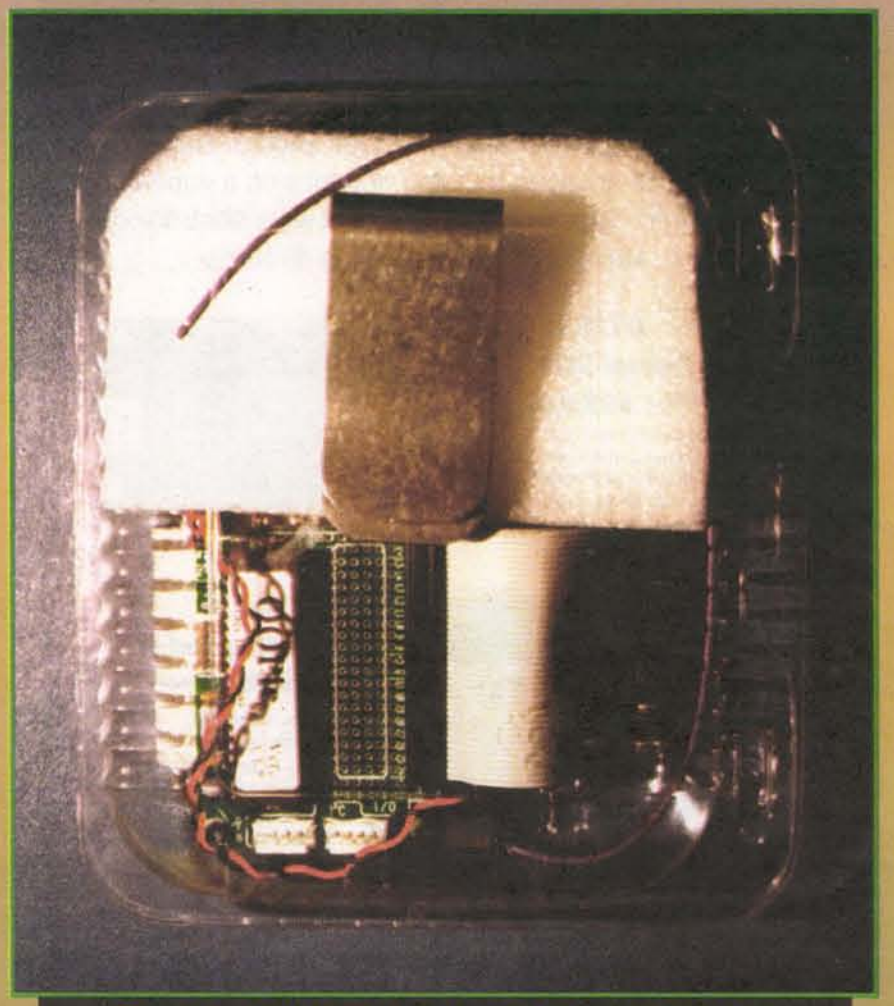


Figure 7. A stick-on clip makes the device portable. Bulky, yes, but light!

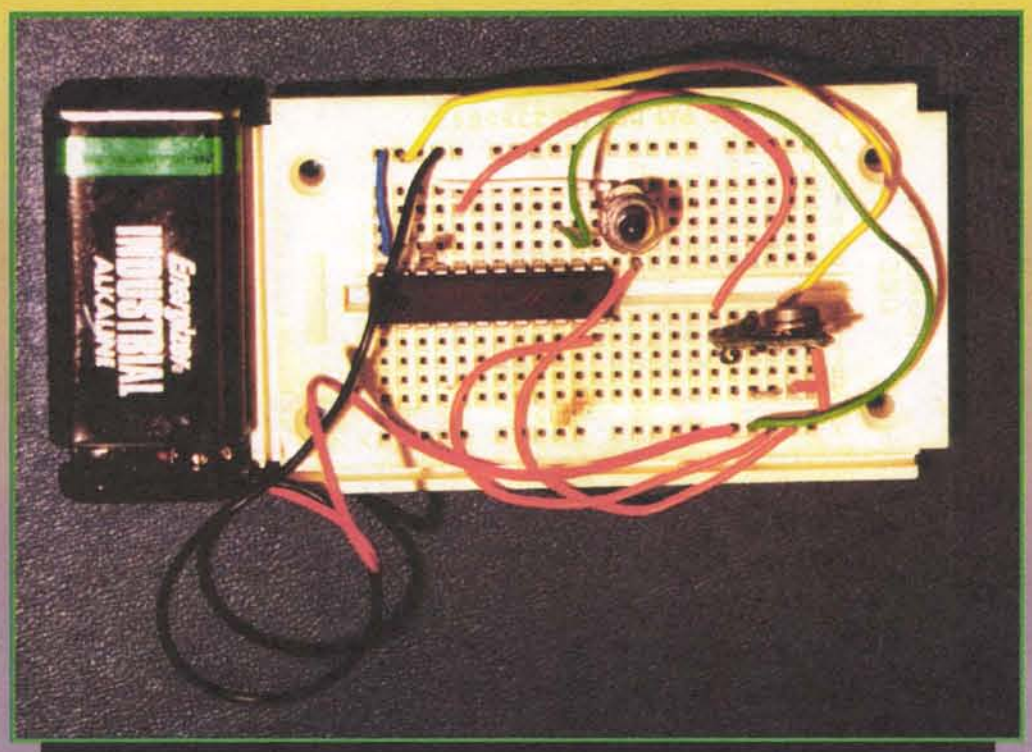


Figure 8. The transmitter half of the kit on breadboard. Pressing the button sends a message, which is selected by moving a jumper wire to the appropriate pin. The antenna is not shown.

```
Dim Queue(4) As New oByte 'Object is array of 8-bit Bytes
Dim I As New oNibble      'Object is 4-bit nibble
```

An output is provided for a buzzer — optional, but nice.

This virtual circuit links the data input to the Data Ready line to its event handler.

```
'configure Scanner
 'Sets up I/O for HT decoder chip
 Msg.IOGroup=2             'Using lines 16-23 Message
 Msg.Direction=cvInput     'Flow is Input
 '--
 DR.IOLine=24              'Use Line 24 for Data
                           'Ready
 DR.Direction=cvInput      'Flow is Input
 '--
 Buzz.IOLine=25            'Use Line 25 for Buzzer
 Buzz.Direction=cvOutput 'Flow is Output

LG.Input1.Link(DR.Value) 'Link gate to Data
                          'Ready
LG.Output.Link(Scan.Operate)    'Link gate to event
                                'handler
ScanLG.Operate=cvTrue           'Make gate active
```

The handler treats the eight data inputs "Msg" as a one-byte number and formats it for the screen. If no presses are down, the transmitter sends "0" as data. An "All OK" message is displayed. The bulk of the code below handles a message queue that allows the last four messages to be displayed on the LCD.

```
 Sub Scan_Code()
'Handles the scan routine
Call ClearLCD       'wipe the screen
If Msg.Value = 0 then      'no presses down so no
                           'error messages
LCD.String="All Presses OK"
Queue(1).Value=0           'clear history
Queue(2).Value=0
Queue(3).Value=0
Queue(4).Value=0
Else
Queue(4).Value=Queue(3).Value     'roll the message
                                  'down a line
Queue(3).Value=Queue(2).Value
Queue(2).Value=Queue(1).Value
Queue(1).Value = Msg.Value 'new message at top

      For I = 1 to 4              'now display the messages
          If Queue(I).Value > 0 Then 'don't show empty
messages
              Call PositionLCDCursor(I,1) 'find the line
              LCD.String="Press " + Str$(Queue(I).Value)
              + " Down" 'show the message
          End if
      Next I

      Buzz.Value=1          'Buzz!
      OOPic.Delay=50:       'Hey, I read it in a book
      Buzz.Value=0          'Unbuzz
 End If
End Sub
```

This routine could be modified to present any imaginable messages. The OOPic has a spare EEPROM socket, so quite a lot of text could be stored and retrieved with a simple CASE statement. There are OOPic objects geared to just this sort of application.

The virtual circuit for displaying messages is the LCD driver from the last project. Since it is driving the same Optrex 4x20 LCD, nothing changes in the listing. Rather than repeat that code here, look at the full listing at http://www.nutsvolts.com. The main routine looks pretty lame. All it does is call the routines that set up the virtual circuits.

```
Call IOSetup 'Set up the hardware and virtual circuit
```

Indications of success

Preliminary tests show good results — the messages get through without garbling if the operator is in the room with the transmitter, or no more than one wall away. Repeaters are going to be needed for full coverage.

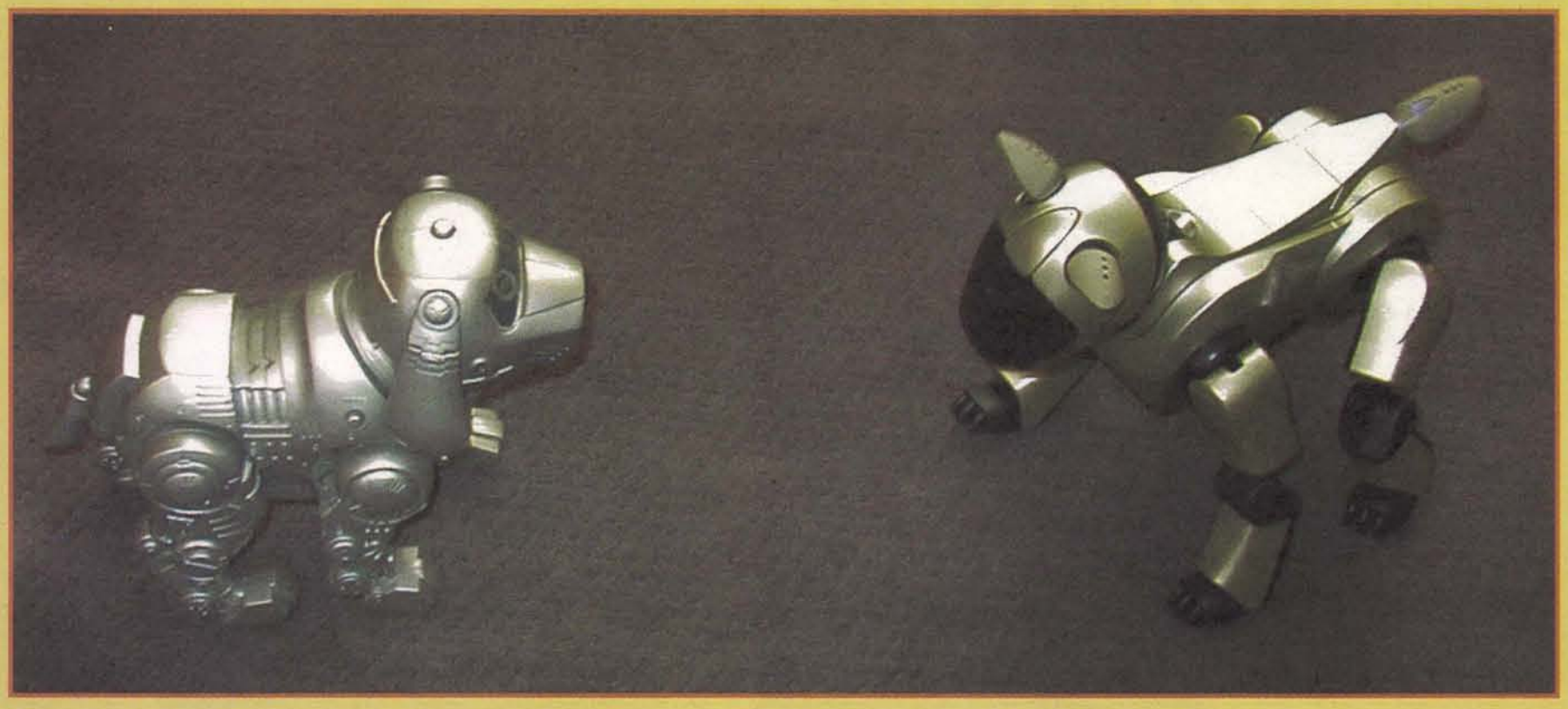
Batteries last about 12 hours, ample reserve for an eight-hour shift. The LCD is the big power hog, followed by the RF receiver.

Figure 8 shows the breadboarded transmitter. This was used to test the reliability of transmission during design, and to generate the messages that appear in the photos. The next step is to marry it to the data network. **NV**

by Jeff Mazur

Part 1

AIBO the Robotic Pet



Move over Tekno, there's a new dog in town.

The AIBO ERS-210 Entertainment Robot from Sony packs a serious amount of hardware and software into a tiny package to emulate a small pet. This autonomous creature interacts and responds to its environment more than any other consumer virtual pet, albeit at a much heftier price.

Adopting AIBO

AIBO gets its name from Artificial Intelligence roBOt. Also, "aibo" is the Japanese word for "pal." Walking on four articulated legs, AIBO operates autonomously, responding to its environment and making its own decisions. Coupled with the standard AIBO Life software, the robot matures through several stages, each with different behavior patterns. How the behavior changes, and at what rate, is directly controlled by how much attention the robot receives (more on this later).

One does not "buy" an AIBO; rather it is "adopted." AIBO owners almost exclusively refer to their AIBO pets by name. Indeed, one of the first responsibilities as an owner is to give your pet a name (via the "Name Registration" voice command). After registering a name, AIBO will respond when called. Don't expect AIBO to talk back verbally, however (or even with normal pet sounds like barking or "meow"). AIBO currently only responds with flashing lights and tonal melodies (although software exists to add your own speech and/or music cues to AIBO's vocabulary).

What AIBO does next depends upon a number of factors. If left alone, it will explore its environment, walking around and seeking out human interaction. By pressing one of several sensors on the robot, you can satisfy this need for attention. You can also provide verbal feedback, such as "Good boy/girl," "Bad boy/girl," or "Don't do that!" AIBO will then modify its behavior accordingly. You can also press combinations of these sensors to force the robot into a rest mode (keeping it from walking around) or into a sleep mode (when you really don't want to hear from it). AIBO will also put itself to sleep when it gets bored and wake itself up after it has rested.

The ERS-210 is actually Sony's second attempt to bring robotic pets to the consumer. Although the first generation was clearly canine in appearance, the 210 seems a bit schizophrenic in that it passes equally well as a dog or a cat (the 210 also has been referred to as a

Figure 1. AIBO comes in silver, black, or gold.

Figure 2. Using the small tool (front), each of the four legs can be removed.

AIBO Oriented Web Sites:

AiboPet (lots of great technical info and AIBO tools)
http://aibopet.com

aibosite and aibonet
(combined site with AIBO info, pictures, videos, software, and more)
www.aibosite.com/

AIBO Webring
(Websites by AIBO owners and others)
http://neuro-trials1.mgh.harvard.edu/aibo/aibo.shtml#01

aiboWORLD (another European/UK site)
www.aiboworld.co.uk/

ClubAIBO (BBS type site for sharing info on AIBO)
www.clubaibo.com/

Sony (main AIBO website with links to 3D virtual AIBO)
www.aibo.com/

Sony (European website with lots of videos)
www.eu.aibo.com/

RoboCup info
www.robocup.org/resource/6.html

lion cub). Of course, some argue that it must be a dog since it relishes attention and responds to human commands (please, no letters from cat owners!) In any case, the 210 also comes in three colors: silver, black, and gold (see Figure 1). It is interesting to compare the ERS-210 with its predecessors and see how much progress was made in just 18 months.

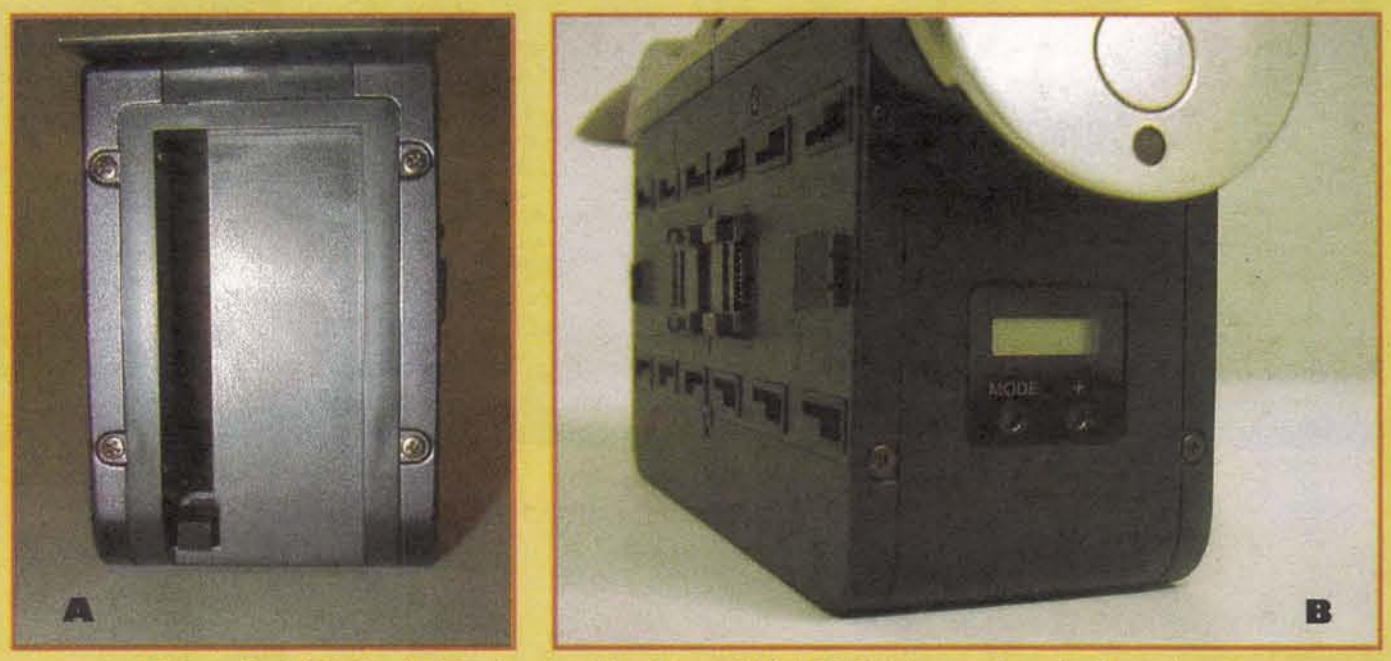


Figure 3. a) PC Card slot at rear of body, and b) LCD display and controls on front.

History of AIBO

Following the popularity of the Tamagotchi and Furby virtual pets, Sony launched the first AIBO Entertainment Robot, the ERS-110, in June of 1999, with only 5,000 units for sale over the Internet (3,000 in Japan and 2,000 in the US). The units in Japan were completely sold within the first 20 minutes while those in the US were gone in four days (despite a $2,500.00 price tag). In response to the strong demand, Sony re-introduced a slightly improved version, the ERS-111, in November of 1999. Once again, the meager 10,000 units available fell far short of the over 135,000 orders received and "adoption" of these units was processed by a lottery.

The first generation ERS-110 and 111 have garnered more than their share of public attention including the covers of *Time* and *Fortune* magazines, as well as cameo roles in a major music video and the MTV series "The Real World." AIBO clubs and websites have popped up to support the burgeoning interest in these robots. Hackers have dissected the hardware, as well as the operating software to ferret out its inner workings, despite numerous protection and encryption schemes (as well as legal warnings) employed by Sony.

Sales of the second generation ERS-210 began in November 2000. With improved performance, voice recognition, and more expressive capabilities – plus a $1,000.00 reduction in price – this model is sure to set new sales records, as well. Compared to the previous models that had 16 joints and 18 degrees of freedom, the ERS-210 has 20 joints and 20 degrees of freedom (three in the head, three in each of four legs, two in the tail, one in each of two ears, and one in the mouth). Additional touch sensors on the chin and back, plus new LEDs in the face and tail, increase the robot's sensitivity to human contact and its ability to express a variety of emotions.

AIBO owes much of its design to research on "RoboCup," an international project to promote robotics and artificial intelligence. Just as the "holy grail" of computing was once to build a computer that could beat a world champion at chess, the ultimate goal of

Figure 4. Pressure switch at the bottom of each paw.

RESOURCES

Sony Entertainment Robot America
E-mail: era.office@am.sony.com
Phone: 1-888-917-7669

Further info on AIBO development and Open-R:

"An Open Architecture for Robot Entertainment," Proceedings of the First International Conference on Autonomous Agents, ACM Press, 1997, pp.435-442

"Development of an Autonomous Quadruped Robot for Robot Entertainment," Autonomous Robots, 5, 7-18 (1998)

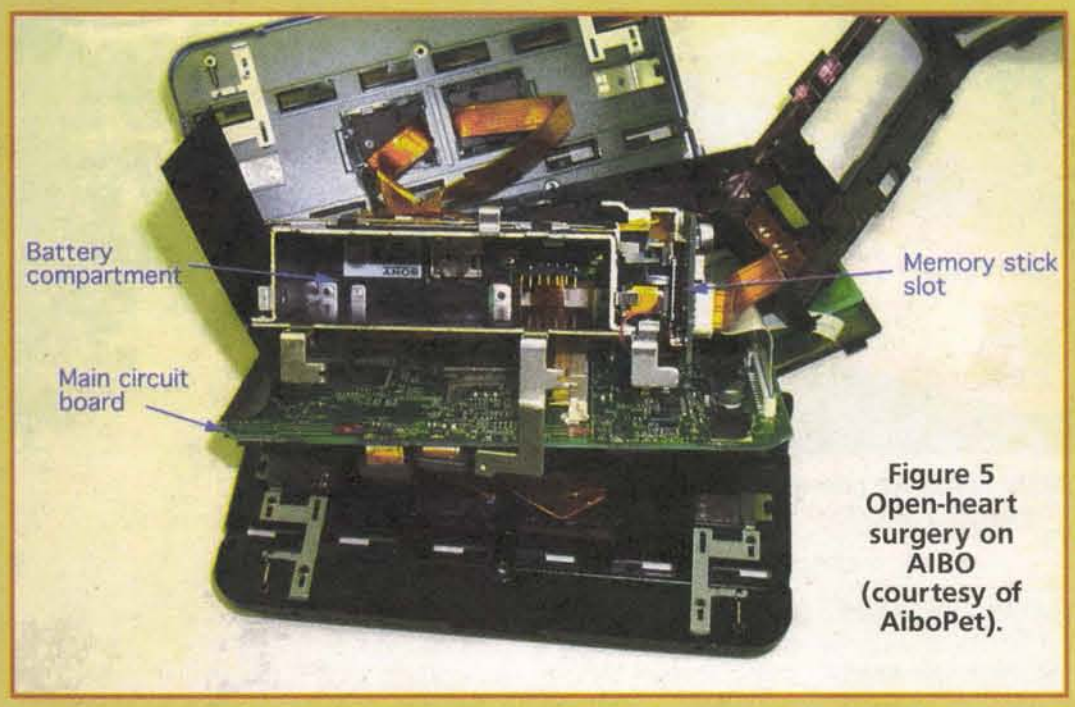


Figure 5 Open-heart surgery on AIBO (courtesy of AiboPet).

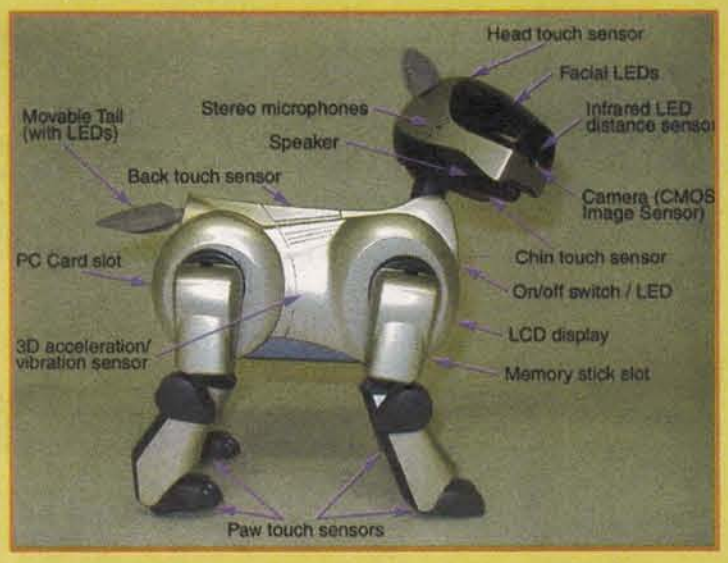
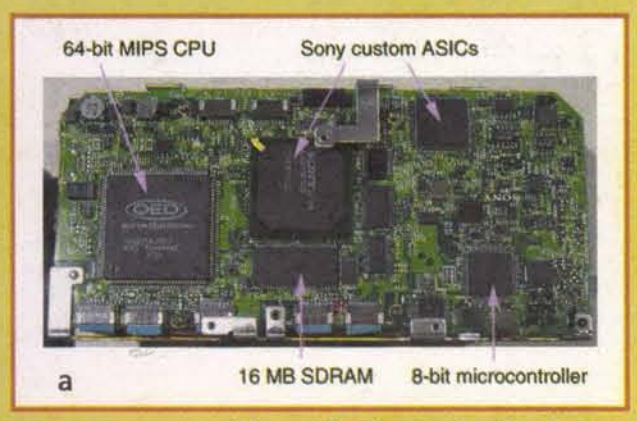


Figure 7. Location of the sensors and other major components.



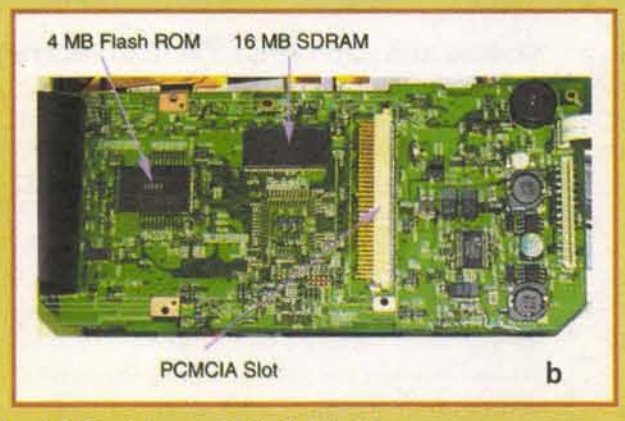


Figure 6. The main circuit board, a) left side and b) right side (courtesy of moolabooga and AiboPet).

RoboCup is to "by the year 2050, develop a team of fully autonomous humanoid robots to compete and win against the human champion soccer team." Quite a lofty goal indeed, but even if this proves optimistic, a side-effect of this program is sure to be better consumer robots for the home like AIBO.

Inside AIBO

The ERS-210 consists of five major components: a body unit and four leg units. A small tool is included which allows removal of the leg units (see Figure 2). With the legs removed, access can be made to the PC slot in the back (see Figure 3a), as well as the small LCD display and controls on the front of the body (see Figure 3b). These controls can be used to set the robot's internal clock and speaker volume level, as well as checking on the battery condition. A duplicate set of display and controls can also be found on the optional Energy Station recharger, which lets you make changes without removing the legs.

Although each leg unit is slightly different on the outside, they each contain three actuators to control shoulder tilt (in/out) movement, shoulder rotation, and knee rotation. Each actuator also includes an embedded potentiometer to signal back the exact position of the joint. At the bottom of each leg (under the paw) is a pressure switch (see Figure 4).

Inside the body of AIBO are the main circuit board, battery, and a memory stick slot for the optional software. Temperature, vibration, and acceleration sensors are also found here along with a clock/calendar circuit. A touch sensor on the back invites human interaction and allows the robot to react accordingly. Sticking out the back of the main unit is the small tail that can move up/down and left/right. There are also two LEDs at the tip of the actuator which light up the tail (via a lightguide) to indicate what the pet is doing or thinking.

Disassembly of the main unit is fairly straightforward (albeit not recommended) as shown in Figure 5, and does not require any special tools (except perhaps nerves of steel). Sony has done a remarkable job of packing so much mechanical – as well as electronic – hardware into such a small space. Figure 6 shows both sides of the main circuit board and identifies most of the major ICs. The primary CPU is a Quantum Effect Devices RM5231A-200H which is a 200MHz, MIPS IV compatible, RISC device with 64-bit internal architecture, and a 32-bit system bus. An additional eight-bit microcontroller performs I/O functions, as well as supporting the main CPU (including powering it up and performing a watchdog timer function). This chip is an NEC D780023AY running at 4MHz and includes 24KB of ROM and 1KB of RAM, an analog-to-digital converter, the clock/calendar, and two serial ports.

Dynamic memory consists of two NEC D4518163G5-A80 memory chips giving a total of 32MB of SDRAM. Read only memory is in a single Toshiba TC58FVB321FT-10 providing 4MB of flash ROM. Several custom ASICs round out the major components. As in previous models, various components communicate using the

AIBO Vies for Attention with Roo

It is interesting to note that just as I was evaluating AIBO, a new kitten was brought into our home. Since we already have an adult cat and dog, I was curious as to how they would react to these two newcomers. AIBO came first and, as might be expected, both animals had little interest in this clunky, slow moving piece of plastic. Perhaps the lack of smell added to their indifference, but after nothing more than a passing curiosity, they promptly decided to ignore this intruder.

A week later, when our next houseguest, Roo, came to visit, things were quite different. Neither animal was happy to see this six-week old kitten jaunting all over the place. The reaction was immediate (growling and hissing), and after four weeks together, things are only slightly calmer now. I had forgotten how much energy and spunk kittens have. And did I mention fearlessness?

So naturally, I also began comparing AIBO to Roo. This is not unfair since Sony has been portraying AIBO as a serious alternative to a real pet. Notwithstanding their claims that it won't "leave little batteries around," it's hard to find many reasons why someone would choose AIBO over a real pet. Certainly, AIBO can impress the technophile and does have a certain "coolness" factor. And you can grow attached to the little guy. But it's hard to compete with a living creature.

First, there is the shear mobility and expressive behavior. AIBO can't come close to the feeling of a small pet hopping into your lap or rubbing up against your face. Despite AIBO's technical ability to walk, see, hear sounds, etc. – and I certainly appreciate what a feat this is for a mechanical robot – one can only marvel at the capabilities of even a baby animal. So, although I love AIBO for what it is, I would have to say that most people will still find a real kitten or puppy a much better pet, paws down.

Figure 8. What AIBO sees through its CMOS camera (courtesy of Bob Harting).

Figure 9. AIBO software comes on tiny memory sticks.

Open-R™ bus, Sony's scalable architecture, and 12 Mbs interface for Robotic Entertainment Systems. All of this hardware is used to run Sony's Aperios Real-Time Operating System with the memory stick acting as a virtual disk.

On top of the main unit is the head module that is controlled by three additional motors giving it up/down, left/right, and rotational movements. Inside the head are two microphones for stereo sound pickup, a speaker for sound output, and six LEDs for emotive expression. A CMOS camera and infrared sensor at the front of the head give the robot "sight" and primitive distance detection. Two moveable ears, a mouth, and touch sensors on top of the head and under the chin allow additional human interaction. Figure 7 shows the location of each sensor and other major components. Although the camera has a resolution of only 176x144 pixels, it seems adequate for the job (see Figure 8).

Fortunately, some thought was given to the ruggedness of the external parts. The tail is made of soft rubber, which bends and will pop off its actuator if overstressed. Likewise, the ears are bendable and attach to their actuator through a stress relieving arrangement. During my testing, one ear stopped moving although you could hear the actuator turning underneath. Simply pressing down on the center of the ear restored proper operation. If any of the main motors jam or overheat, the robot goes into a safe mode which should prevent further damage. A long press on the head sensor brings the robot back to "consciousness." While Sony deserves credit for anticipating a certain degree of mishaps, it would still be unwise to unleash a small child on the fragile AIBO (in other words, it would not last long on BattleBots!).

Software Options (AIBO-ware)

While AIBO will operate without any additional software installed in the memory stick slot, it is limited to pre-programmed motions and performances built into its ROM. To get the most out of owning an AIBO, you will need to purchase one or more of the optional software packs (see Figure 9). Most owners will start with the AIBO Life software that emulates a growing animal, giving it autonomous behavior, which matures from infant to adult while learning new behaviors with increased human interaction. AIBO Life also adds voice recognition, speech imitation, and photo taking capabilities. Viewing of the photos, however, requires a Windows PC (equipped with a memory stick reader) and optional software such as the AIBO Fun Pack (see Figure 10). This software also lets you examine various parameters and other information about AIBO, including the diary that AIBO keeps.

Other AIBO-ware titles currently include Hello AIBO! and Party Mascot for demonstrating AIBO's capabilities. These programs turn AIBO into a fully mature pet with special "show-off" behaviors like playing "rock, paper, scissors." AIBO Master Studio is a programming kit that allows you to create and edit original motion and sound data. There is also a wireless LAN card that lets you control AIBO from your PC.

Next month, we will take a closer look at the software side of AIBO. A detailed outline of how AIBO matures from infant to adult using the AIBO Life program will be presented. Several shareware applications that let you dissect the programming of AIBO will also be discussed.

NV

ERS-210 SPECIFICATIONS:

Movable Parts:	Mouth — up/down Head — up/down, left/right, rotate Leg (x4) — shoulder tilt in/out, rotate; knee rotate Ear (x2) — rotate Tail — up/down, left/right
CPU	64 bit RISC Processor
Memory	32 MB Main memory 8 MB memory stick 4 MB of flash ROM
I/O Expansion	PC card slot Type 2 Memory stick
Built-in sensors	CMOS video camera (176x144 pixels) Miniature microphone x2 Temperature sensor Infrared distance sensor Acceleration sensor Vibration sensor Pressure sensor (Head, Back, Chin, and Paws (x4)
Expression	Miniature speaker Red/Green LED eyes Blue/Orange LED tail
Built-in clock/calendar	
LCD Display	Setting clock, volume level, battery level
Operating time	Approx. 1.5 hours
Dimensions (WxHxL)	6" x 10.5" x 10.8" excluding tail
Weight	3.3 lbs.

ACKNOWLEDGEMENTS

Thanks to Jon Piazza of Sony ERA for the loaner AIBO and technical background information. Also to AiboPet and moolabooga for technical info and pictures. Finally, thanks to Al Peck for various AIBO pictures and Bob Harting for the AIBO camera picture.

Figure 10. The AIBO Fun Pack software lets you view the pet's diary including pictures that it has taken. It also lets you change various parameters, such as what time to wake up (courtesy of AiboPet).

Have you ever paid top dollar to have a telephone service person wire a jack for you? It probably took him/her all of five minutes and cost you several days' pay. With a little knowhow, you can wire your own telephone jacks and save some dough.

by Sean Troutner

Telephone Wiring Demystified

Telephone wiring, for all practical purposes, still remains a real mystery to many folks who have already tackled similar tasks, such as wiring electrical outlets or even cable TV.

In its most rudimentary form, telephone wiring is nothing more than wire that carries an electrical voltage from one point to another. I believe that most folks feel overwhelmed when it comes to telephone wiring because of the number of wires and the color-coding.

The focus of this article is not to turn you into a service repairperson, but rather to give you the courage and confidence to wire your home for telephones as you see fit.

Telephony 101

Before we dive headlong into any further discussion, we need to define a few of the terms that will be used throughout the text. Any reference to the phone company will mean your local phone company. The term NID, or Network Interface Device, refers to whatever device your phone company employs to provide termination of their wire and yours. The term line will only be used to reference an individual phone line provided by the phone company. Finally, the term wire will apply to the individual wire or wires that connect your jack(s) to the NID.

The Network Interface Device

The network interface is the point at which your house wiring connects with the telephone company's cabling (also called the local loop). This is where the phone company's responsibility ends and the consumer's responsibility begins. It's a good idea to know where your NID is located should you have trouble with your line or need to add wiring to your home.

Depending on your phone company's policies, practices, and standards, your NID may be found in any number of places, some of which can be quite creative. Many phone companies have adopted the practice of mounting NIDs on the exterior of homes. In some tract housing, the NID is located inside an exterior wall, accessible through a panel marked "telephone," usually next to the electric meter. If you do not find your NID on the exterior of your home, try the interior. Check the basement or the attic, following the telephone wires, if necessary. To aid in your quest, take a look at the photos of various NIDs included here. Most of the newer NIDs installed by telcos today have a test jack built into them for customer testing and isolation (see Figure 1).

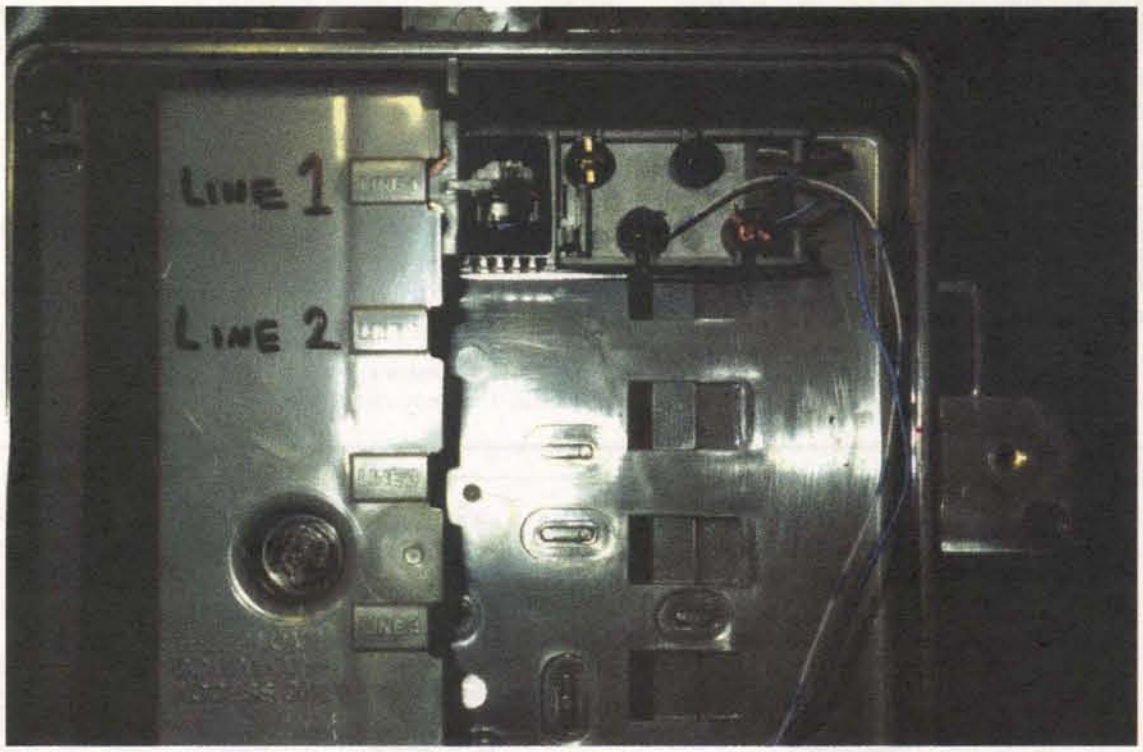


FIGURE 1: Close-up of the test jack with cover removed for clarity.

Telephone Wire

In theory, telephone wiring should last forever. If done correctly, your wiring projects can be done once and forgotten about with a little know-how.

Telephone wire is available just about everywhere these days. You can purchase wire at hardware, grocery, and even convenience stores. The truth is that all wire will never be created equally.

Your conductor colors	Corresponding jack screws	NID screws/terminals
Green	Green	Green
Red	Red	Red
White/blue	Green	Green
Blue/white	Red	Red

Table 1

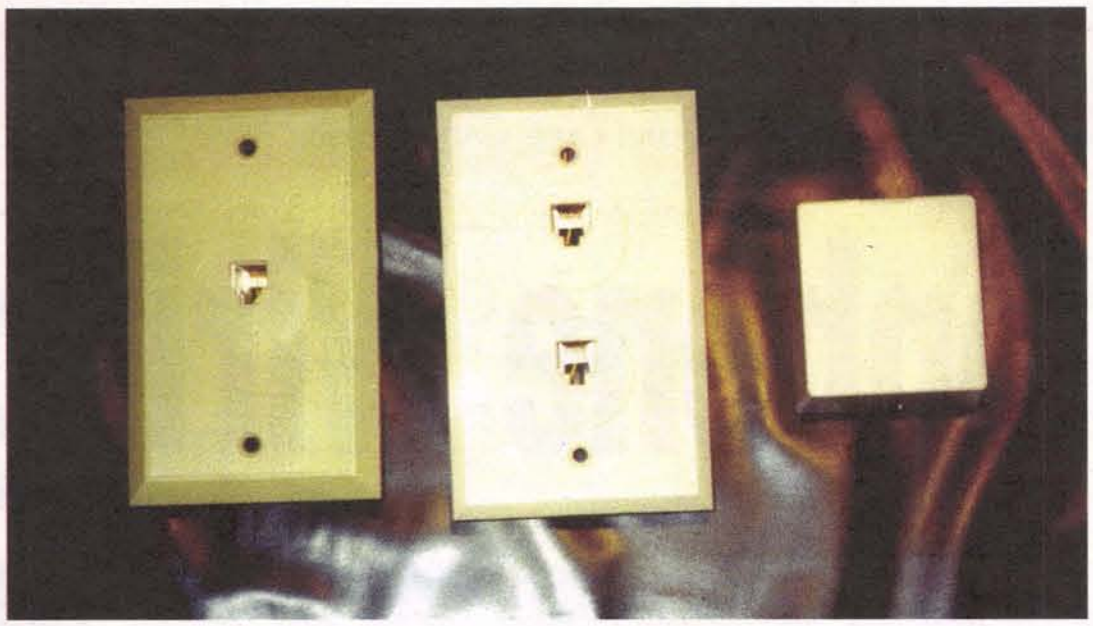


FIGURE 2: From left to right: Single flush jack, dual flush jack, and surface jack.

Table 2

Secondary Wire Colors	Corresponding Jack screws	NID screw/terminals
Yellow	Green	Green
Black	Red	Red
White/Orange	Green	Green
Orange/White	Red	Red

Telephone wire is available for a wide variety of applications, from line cord material to hybrid cables with wire for voice and video in the same sheath.

A successful method of choosing the right kind of wire for any application is to first understand the basic differences of wires used for telephone installation. The following is a list of the basic types of phone wire available:

• **Line Cord (a.k.a. Silver Satin)** is a flat ribbon-like wire with two to eight conductors primarily used for the connection between the telephone instrument and jack.

• **Category 1 wire (Cat 1)** is a round wire containing anywhere from three to eight conductors. Most older homes are wired with Cat 1 wire. Cat 1 simply means that there is only a slight twisting of the conductors under the sheath (a capacitance twist).

• **Category 3 wire (Cat 3)** is the same as Cat 1, except that the conductors may be paired with color-coding, and the twisting of conductor pairs is more apparent.

• **Category 5 wire (Cat 5)** and above is distinguished from Cat 3 by the tight twisting of pairs. Cat 5 was designed with 10baseT and higher networks in mind, but is slowly becoming the "de facto" standard for voice wiring.

The twisting of pairs in Cat 3 and better is designed to minimize the induction of noise into the pairs. This induction may cause interference with the operation of the phone line. Induction between pairs is known as "cross-talk," and this is very common when two or more phone lines are working in a Cat 1 wire, where the twisting of conductors is minimal.

High voltage sources, such as neon signs, induction motors, and fluorescent lights tend to wreak havoc with Cat 1 wire and will always be picked up by line cord wire in close proximity.

Wire, regardless of category (except line cord), is rated for either indoor or outdoor use. *This is very important.* Exterior grade wire has a thicker PVC coating (sheath) that will withstand freezing and sunlight for extended periods. A common mistake is to use interior wire on the exterior of homes. This shortens the life of the wire, as the sun tends to break down the sheath and expose the conductors to the elements. Once this occurs, the wire literally sheds all insulation and will short with the slightest amount of moisture. **Never use line cord outdoors for permanent wiring!** To do so is only asking for trouble.

Telephone Wiring Methods

Telephone wiring practices can be divided into two categories: looped or home run. It is possible and common to mix these practices, but for clarity, I will discuss these practices and their advantages separately.

The most common method used to wire a home is the familiar "loop" method. If you have done any electrical wiring in a home, you should be familiar with this method. The "loop" method is the practice of running a wire from jack to jack with only one wire run to the NID. This method is still the most commonly used and is popular among electricians in new home construction. Looping has its flaws; the most obvious of which is if a wire between the first jack and the interface goes open. In this event, you have to rewire a portion of the loop.

The second method is to "home run" each wire to its own jack. Simply put, each jack has a dedicated wire. These wires may be brought back to one central point or directly to the NID. A major advantage of home run wiring is the ease with which trouble can be isolated. Home run wiring allows you to quickly add lines and alter your wiring configuration.

To identify what type of wiring

Suggested Tools

- Screwdrivers, Phillips and Standard
- Analog VOM
- Wire Strippers
- T-25 Staple Gun (or equivalent)
- Telephone (in working order, corded)
- Tone and Probe set (optional)

method was used in your home (assuming you do not know), do a quick inspection of your NID. At your NID, you will find terminal lugs or screws to which the wire from the house is terminated. If there is only one wire to the NID and you have multiple jacks in the house, it is safe to say that you have looped wiring. If there are multiple wires terminated, then it is likely that you have home run wiring, or a combination of looped and home run (assuming the number of jacks is greater than the number of wires present at the NID).

Wiring Tips

Wiring is not a daunting task; 90% of the chore of wiring is merely choosing a route that is feasible and practical. Some tips to keep in mind when wiring are as follows:

• When drilling a hole through an exterior wall, always drill the hole at an angle. If you are drilling from the outside to the inside, the tip of the drill bit should be higher than the chuck. Inversely, when drilling from the inside to the outside, the chuck should be higher than the tip. This will help keep water from entering the exterior walls.

• Always use caution when drilling through any part of a structure. Be sure to inspect the area you plan to drill prior to commencing. Check to see if there are hazards present, such as electrical wiring, ducts, or pipes. **NEVER** drill with your hand on the drill bit! Doing so may result in electrocution if you happen to hit a live electrical wire.

• When drilling through subfloors covered in carpet, use a sharp knife to cut an "X" across the center of the hole you wish to drill. Several passes with the knife may be necessary to cut completely through the carpet. This will not visibly show and will prevent the carpet from developing a "run" when you drill through it.

• When running wires through crawl spaces, be sure to keep the wire off of the ground, especially if you have had trouble with rodents. Rodents love to chew on wires and will definitely do damage to wires on the ground. Do not secure wires run through crawl spaces very tightly. If a wire goes bad, you will have to enter the crawl space to replace it. By leaving the wire loose you can "chase" a new wire in while pulling out the old wire and still maintain ground clearance.

• When installing new wire inside interior walls, use a wall box (I call them "after thought"

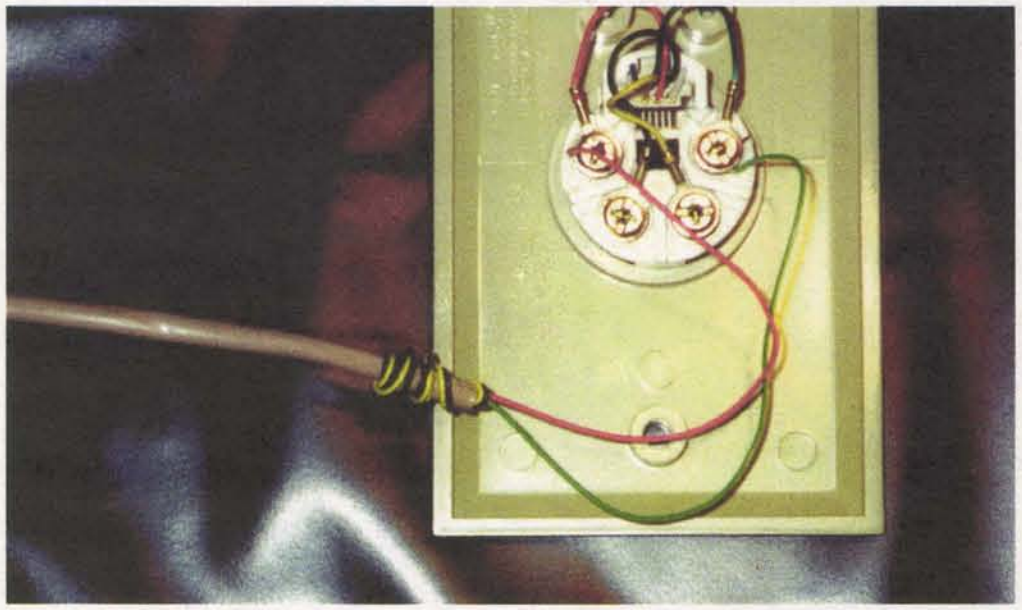


FIGURE 3: Single line termination example — with a single flush jack shown.

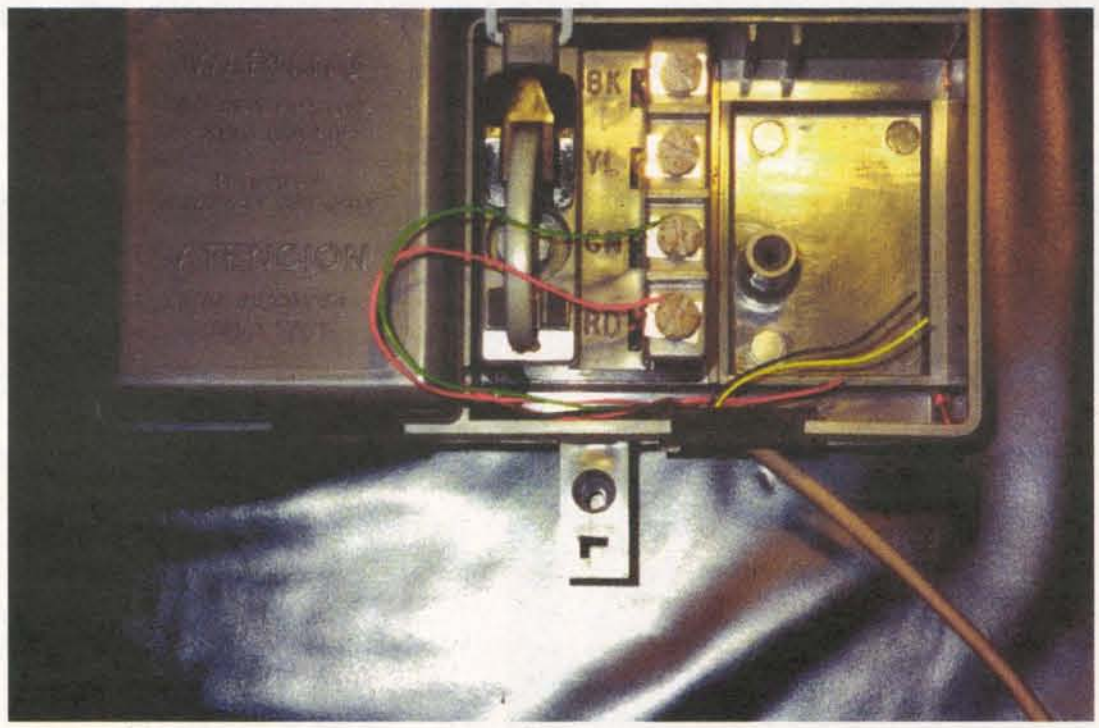


FIGURE 4: Termination of one wire at NID. Note only the red and green terminals are used.

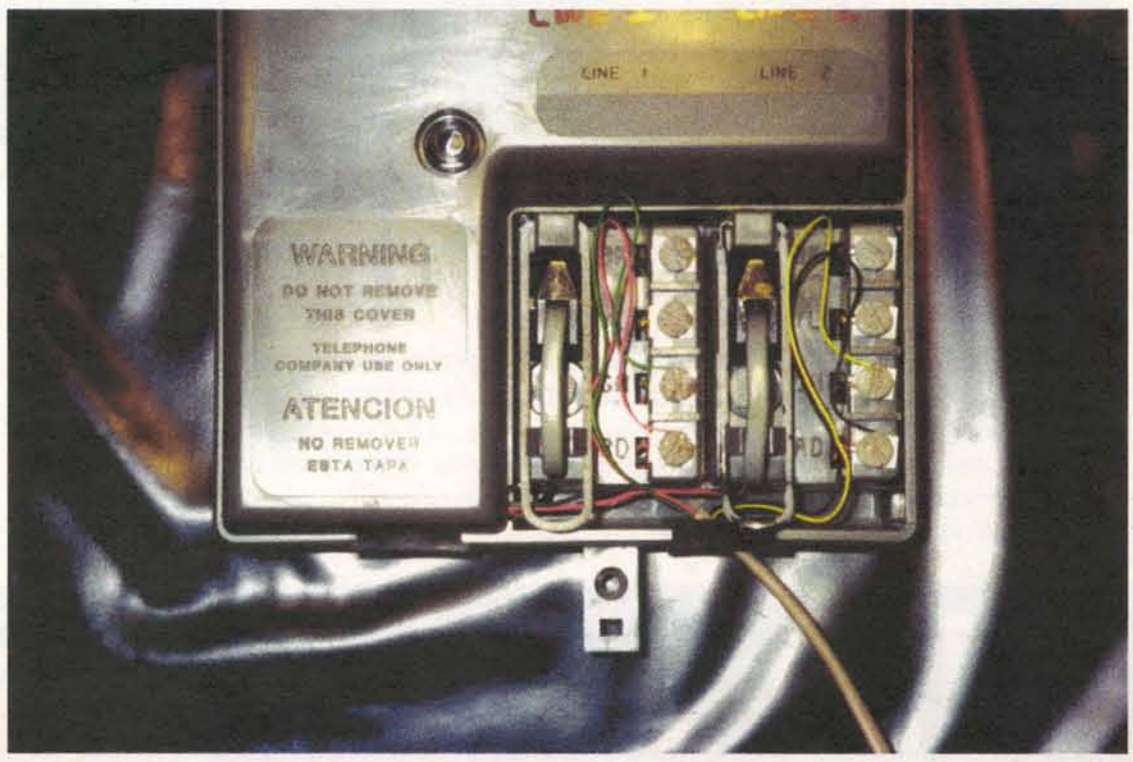


FIGURE 5: Termination of two lines at NID. Again, only the red and green terminals are used.

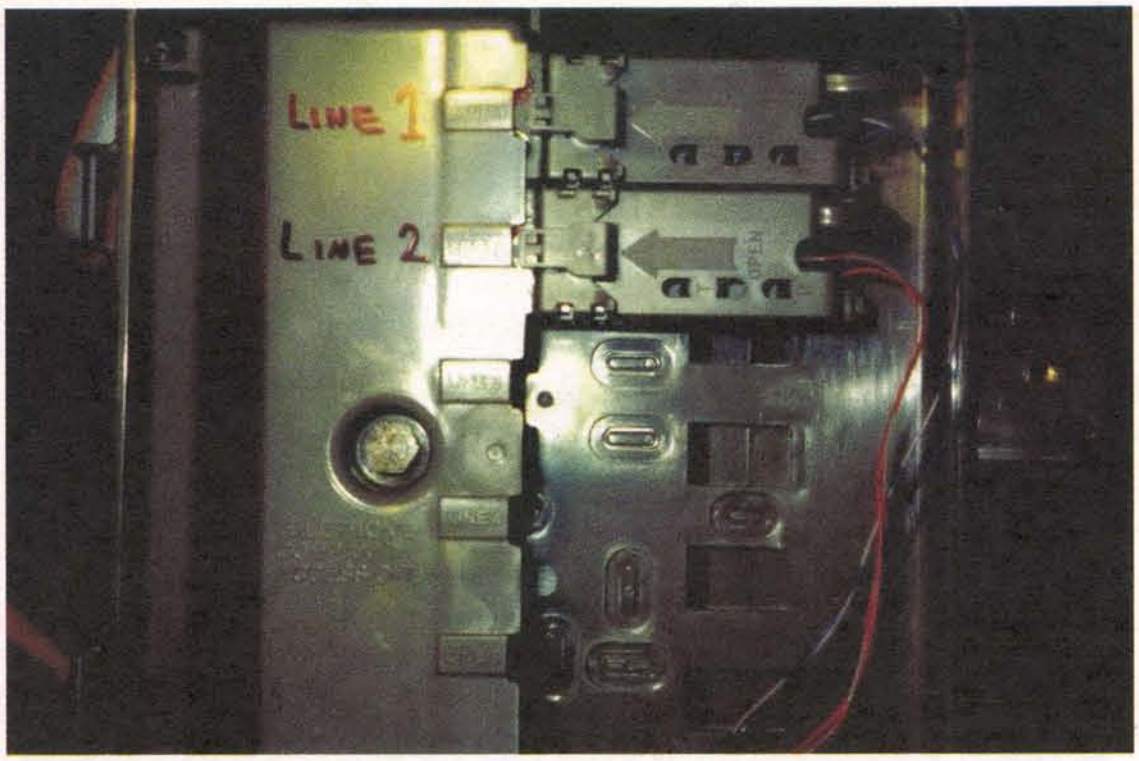


FIGURE 6: Newer NID with two lines terminated.

boxes) that is designed to be secured to drywall. These can be either steel boxes with malleable tabs, or plastic boxes with screw actuated "wings." Simply place the box with its opening toward the wall, level, and trace around the box with a pencil. Then cut the rough opening. Use care when cutting holes in any wall, as the danger of live wires may exist. I highly recommend using only hand tools for the job.

• Remember to seal all holes in exterior walls with caulk, and to use a "drip loop" in the wire on the exterior of the structure. Doing so ensures protection from water entering exterior walls.

• If you run a wire on the outside of a structure, be sure that the wire is rated for outdoor use.

• Never bury indoor or outdoor wire directly. Use conduit or direct buried cable.

• Attaching a wire to the exterior of a structure can be accomplished by using a staple gun (T-25) if the exterior is made of wood. Be careful when using a staple gun. If a staple pierces the jacket of the wire you have two choices: re-run the wire, or mark the entry wound for future reference, because you will probably have trouble there.

Telephone Jacks

Jacks are available in a variety of styles and colors. Jacks may either be surface mount or flush

Related Web Sites

www.levitonvoicedata.com: Leviton makes jacks and accessories for residential/commercial wiring. Under Learning Center/Training Resources, there are wiring diagrams and color comparisons. This site has many helpful tips and explanations.

www.specialized.net: Specialized Product Companies offers hard-to-find tools and test equipment for the telecommunications industry. They sell direct to the public. Minimum order is $20.00.

www.sandman.com: Mike Sandman has some off-the-wall and unique items, as well as extremely hard-to-find telephone accessories. Not the cheapest vendor on the block, but if you can't find it elsewhere Mike might just have it.

mount (see Figure 2). Flush mount jacks are used with wall boxes, while surface mount jacks may be screwed or adhered to a surface. When using surface mount jacks on wood surfaces — especially plywood — or in areas where moisture may be a problem, be sure to use screws in addition to the double-backed tape.

If you are replacing an existing surface mount jack on drywall, it is a good idea to score the area around the jack before removing it from the drywall — otherwise you may have to do drywall repair.

When selecting a jack, look at the jack's physical construction. Albeit that most jacks are made in Taiwan, buying a cheap jack will often result in failure from merely plugging a cord into it.

Select a jack that suits your needs, i.e., using a "duplex" jack (jack with two receptacles) will allow you to have two lines in one location, or eliminate the need for a splitter. When buying a surface jack, choose a jack that has enough space to neatly conceal all the conductors, used or unused.

Wiring Termination

Once the wire has been run and secured (if necessary), you are ready to terminate it. The type of wire used will determine the color of the conductors you will terminate. If your wire has a solid red and a solid green conductor (see Figures 3 and 4), these will be the conductors you will use for a single phone line (second line termination instructions to follow).

If your wire has a white conductor with blue striping and a blue conductor with white striping, these will be the wires that you use for the line. Refer to Table 1.

If you are terminating a new wire from an existing jack, simply tie down the same conductors you used at the new jack to the existing jack. If the conductor colors tied to the existing jack that you are looping from differ from the colors you are using, do not panic. Simply tie down your conductors to the green and red terminals of the existing jack.

Wiring telephones jacks is like algebra; whatever you do to one side of the equation, you must also do to the other. Hence, if you use the same conductors on both ends of the wire, you will be successful.

Adding a Second Line

What about a second line, you ask? Now that you know how to wire one line, the second line is just as easy, but requires some preparation work. When adding a second line consider the following:

✓ Is there a jack close to, or at the location where the second phone line will be used?

✓ Does existing wire have enough conductors to accommodate a second line?

✓ Is the premise wiring looped or home run?

✓ Do you need/want to have access to both lines at the same jack?

If you already have a jack close to or at a location in which you would like to have the second line, you will need to inspect the existing wire to determine if the wiring is looped or a home run. This may require you to look in the NID, because what you may think is a "home run" may really be the end of the loop. If the line is looped, and you have at least four conductors in the wire, you are in good shape. (Remember, it takes two conductors for each phone line.)

If the wire is identified as a home run, you will need to determine if you want two lines or one line at the desired location. Assuming you want both lines in the same location, you will need at least a four-conductor wire, and you will need to isolate the wire at the NID. A quick way to locate an individual wire is to short the unused conductors at the jack and then look for the short at the NID using an ohmmeter, or simply remove one wire at a time from the NID until the existing jack is dead.

If you do not have enough conductors to place both lines in the same jack location or there is no existing jack close for you to loop from, you will need to run a new wire.

Terminating a Second Line

Terminating a second line is no different that terminating the first line. Once you have decided where the second line will go and if you want one or both lines at that location, then it's all down hill from there.

If you have an existing jack with four or more conductors in a location that suits your needs and you want both lines to work there:

✓ Replace the existing wall jack (if it is not a duplex) with a duplex jack and wire as follows: Make the top jack line 1 using the red/green screws and the appropriate wires that were terminated to the old jack. Take the secondary conductors (see Table 2 and Figures 5 and 6) and wire them to the red/green screws of the lower jack and to the second line at the NID. This will give you access to both lines, one on each jack.

If you have an existing jack, with four or more conductors, but need a new jack in a location nearby, and you want both lines to work there:

✓ Extend the existing wire to the new jack location, install jack, and terminate same as above.

If you have an existing jack and you only want the second line in that location:

✓ First determine if existing wire is a loop run or a home run:

• If it is a home run, isolate the wire at the NID and connect it to the second line terminals at the NID. Follow Table 1 for wire termination.

• If the jack is looped, use a secondary pair of wires. Terminate at the NID and use the red/green screw terminals on the jack (see Table 2 for wire combinations). Note: You may have to cut the pair through at all other jack locations.

If all else fails, you might consider having your telephone company or an electrician complete the wiring for you. Many times the phone company will discount jack work with the installation of a line, so ask their representatives when ordering the line. **NV**

Sean Troutner is a Customer Zone Technician with Verizon in Illinois. His telephone experience includes business systems, data wiring, voicemail, outside plant, and fiber. You can email Sean at **troutner@shawneelink.net**

Continued from page 42

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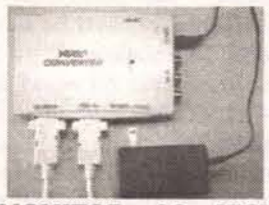

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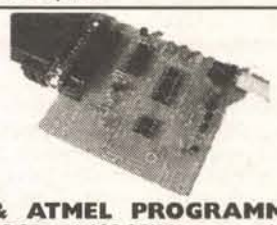

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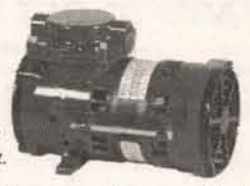

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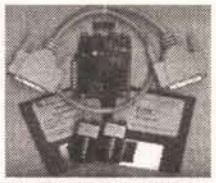

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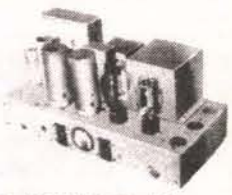

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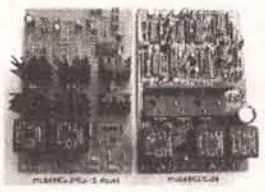

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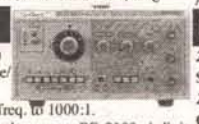

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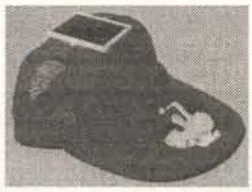

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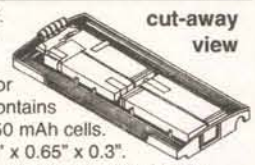

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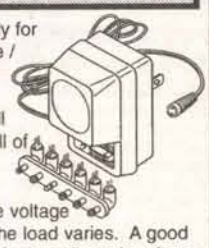

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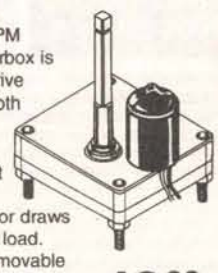

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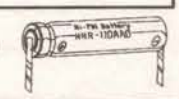

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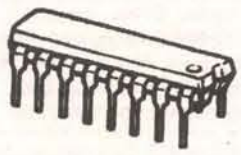

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Questions & Answers

TECH FORUM

This is a READER TO READER Column. All questions AND answers will be provided by *Nuts & Volts readers* and are intended to promote the exchange of ideas and provide assistance for solving problems of a technical nature. All questions submitted are subject to editing and will be published on a space available basis if deemed suitable to the publisher. All answers are submitted by readers and *NO GUARANTEES WHATSOEVER* are made by the publisher. The implementation of any answer printed in this column may require varying degrees of technical experience and should only be attempted by qualified individuals. Always use common sense and good judgement!

QUESTIONS

Send all material to **Nuts & Volts Magazine**, 430 Princeland Court, Corona, CA 92879, OR fax to (909) 371-3052, OR E-Mail to **forum@nutsvolts.com**

Don't forget to check out the new online electronics forums at the *Nuts & Volts* website. There are currently boards for discussing Robotics, Microcontrollers, Radio, Computers, and a General forum for discussing any electronic topic at all. We'll even add new dedicated boards for hot topics. Just let us know!

Want to get a jump on things before the magazine arrives? The Tech Forum questions are posted on our website on or before the first of each month. Unanswered questions from recent issues are there also.

I need a simple switching circuit design to be used on standard automotive voltage (12VDC/~15 amps) with potentiometer/controller to modulate sequentially up to three outputs that will cycle on/off from zero to approximately 2,000 cycles per minute.

Can a common electronic ignition box be modified with a driver circuit using a BASIC-based serial output control program? Or is a simple switching circuit using a potentiometer available?

3011 **Jim**
via Internet

I have a 2.4GHz parabolic dish antenna that I use for wireless video. I have installed a 12VDC winch motor with a 50 amp draw to remotely raise and lower it. The problem is that it goes up and down way too fast. I need to figure out a way of varying the speed of the motor.

3012 **Rick Simard**
via Internet

I recently purchased a small CCD color video camera. It worked fine when I plugged it into the video jack on a VCR, but it doesn't have audio.

I thought I could hook up an electret microphone to the audio jacks and get some sound, but it won't work. The only sound I hear is a click when I turn the microphone on and off.

What am I missing here? Is my idea not compatible with a standard VCR? I'm guessing I need a small amplifier between the mike and the VCR.

3013 **Richard Flaws**
Oswego, IL

I want to use an Apple M0-401 high-resolution monitor on my Apple IIgs system. I'm correct in assuming that the monitor I want to use is a digital, unlike the analog port of my computer.

What is the best approach, if possible, so I can use the monitor with the resolution that I want?

What parts am I going to have to use to get it done?

3014 **Adian Council**
Fort Wayne, IN

I need a bandpass filter for all or most of the audio range, say 20 Hz to 17 KHz or so, that has a center frequency that is sweepable across the entire range. In addition, I would like the passband width (Q) to be variable either continuously sweepable or switch selectable.

I'd like to use a continuous time filter like the UAF42, but it gets complicated changing the values of several resistors simultaneously.

Another thought is to use a pin programmable switched capacitor filter like the MAX264 using a variable oscillator like the MAX038 to clock the chip. I'm a little concerned about noise, though.

I'm uncertain that either approach is the best alternative out there. Can anyone shed some light on a better design alternative?

3015 **James Basinger**
Vesuvius, VA

I've had much difficulty finding an AC adapter for Altima LSX laptop. I was wondering if you could help me find the pinout for this old machine. I thought I might be able to use a standard AC adapter in place of the battery charger, or perhaps build a custom charger for it once the pinouts are known. Any thoughts?

3016 **via Internet**

I have a BellSouth cordless telephone, model 820. When a number button is pushed, there is a delay before the tone is heard. I would like to shorten this delay as much as possible. Any suggestions?

3017 **Rod Bowes**
via Internet

ANSWERS

ANSWER TO #11007 - NOV. 2000

Please tell me the correct name and a source for the metal strips in greeting cards, which have a recorded message or music on them?

The correct name is a "melody IC." There was an article in *Nuts & Volts* about a year ago by Ray Marston.

Don Lancaster's Tech Musings/Oct. '97 has an article on melody chips and a list of sources. This is available on the web at **www.tinaja.com/glib/muse117.pdf**

These chips are generally preprogrammed in massive quantities with one-eight tunes in them. Many appear in tiny three-pin cases.

The following are several other sources on the web:

http://webtronics.site.yahoo.net/webtronics/carmelhapbir.html. Melody IC COB, battery, and piezo all ready to play, as found in Christmas cards and books which play when you open the page. Self-adhesive backing. Tune repeats continuously while power is connected. Total of 128 notes. CMOS LSI. Two supplied per kit. Same as SG7. SG13 1+ $3.50 each.

www.web-tronics.com/soungenkit.html, SG6 melody IC ($3.50).

www.buychips.co.kr/melody_integral.htm, melody chips for watches, etc.

http://npcamerica.com/melody.htm, melody chips.

www.epson.co.jp/device/e/assp/pdf/svm7561.pdf. Up to 16 tunes, mask programmed.

Barry Cole
Camas, WA

ANSWER TO 1014 - JAN. 2001

I want to hook up a Jupiter GPS receiver to any microcontroller to read Lat/Longitude information.

Reading the latitude and longitude information from a GPS receiver is a relatively simple task that can be accomplished by parsing a sting of serial data, sent at 4800 bps, from the GPS receiver.

The October 2000 issue of *Circuit Cellar* details the format of the NMEA RMC message format and provides some additional information.

There have been several projects of this type done with the BASIC Stamp microcontroller. More information can be obtained from the

ANSWER INFO

- Include the question number that appears directly below the question you are responding to.
- Payment of $25.00 will be sent if your answer is printed. Be sure to include your mailing address if responding by E-Mail or we can not send payment.
- Your name, city, and state, will be printed in the magazine, unless you notify us otherwise. If you want your email address printed also, indicate to that effect.
- The question number and a short summary of the original question will be printed above the answer.
- Unanswered questions from a past issue may still be responded to.
- Comments regarding answers printed in this column may be printed in the Reader Feedback section if space allows.

QUESTION INFO

TO BE CONSIDERED FOR PUBLICATION

All questions should relate to one or more of the following:
1) Circuit Design 3) Problem Solving
2) Electronic Theory 4) Other Similar Topics

INFORMATION/RESTRICTIONS

- No questions will be accepted that offer equipment for sale or equipment wanted to buy.
- Selected questions will be printed one time on a space available basis.
- Questions may be subject to editing.

HELPFUL HINTS

- Be brief but include all pertinent information. If no one knows what you're asking, you won't get any response (and we probably won't print it either).
- Write legibly (or type). If we can't read it, we'll throw it away.
- Include your Name, Address, Phone Number, and email. Only your name, city, and state will be published with the question, but we may need to contact you.

TECH FORUM

ANSWERS TO 2017 - FEB. 2001

I need help on a DC drive motor. It, in turn, will work an electric car. I'm winding my own motor using the new superconducting wire. My only dilemma is do I have to keep the motor cooled?

Also, I see very little about this great subject in any local periodicals. Why isn't it open more to us expe rimenters?

As far as I know, there is no such thing as super-conducting wire unless the temperature is reduced to near absolute zero, about minus 450 degrees Fahrenheit. The very best conductor at 68 degrees Fahrenheit, regardless of cost, is Selenium at 1.2 micro-ohm cm.

The next best is copper at 1.7 micro-ohm cm.

Russell Kincaid
Milford, NH

#2 You don't mention what temperature you need for the super-conducting wires. Some super-conducting materials are running quite high on the temperature scale by comparison, which means perhaps less than -100 degrees Fahrenheit, or so.

If you are running in the high temperatures, you can consider using massive peltier devices stacked together to form temperatures perhaps near your desired range.

Liquid carbon dioxide will get you to -78 degrees Celsius [approximately 112 degrees Fahrenheit] while liquid nitrogen [-195°C] or oxygen [-183°C] will do the trick for all temperatures.

However, in most states you need to be registered to purchase these gases, as well as possess the appropriate handling equipment and safety devices such as gloves and a face mask. You also need high-pressure fittings and hoses, as well as small storage devices for the transportation of the gas (Dewers).

At temperatures in excess of -200 degrees and pressures in excess of 2,000 pounds per square inch, these gases are not user-friendly especially for the novice.

Chris
Bieber, CA

#3 Unless you have found a source for room-temperature superconductors, you will need to keep the motor windings at liquid-nitrogen temperature. Not an easy thing to do, which is why you don't see superconducting motors very often.

Robert Zusman
Scottsdale, AZ

BASIC Stamp email list and searchable archives.

See **www.egroups.com/group/basicstamps**.

Aaron
Arcanum, OH

ANSWERS TO #2012 - FEB. 2001

I have a large quantity of audio and video tapes which I would like to erase. Is there something I can put together or buy to accomplish this?

#1 An eraser that evidently uses permanent magnets is available from **MCM Electronics 1-800-543-4330**, catalog number 80-2770, for $9.99. "... simple operation by sliding the tape through ... a couple of times."

It looks like a plastic box with open ends and some neodymium magnets at a few strategic spots.

For heavy duty erasing they have powered bulk erasers priced from $40.75 to $370.00.

Their web site is at **www.mcmelectronics.com**.

If you want to try the permanent magnet trick you can get appropriate neodymium magnets, approximately 2" x 1" x 0.1", catalog number MAG-26, for $1.50 each, from **All Electronics** at **1-800-826-5432**. Web site is **www.allelectronics.com**.

Jack Dennon
Warrenton, OR

#2 Go to your nearest RadioShack and ask for item #44-233 ($36.99), Bulk Tape Eraser. This will do a great job erasing your old cassette tapes.

It's also good for cleaning video tapes.

IMPORTANT WARNING: make sure there are no "valuable" magnetic media (disks and tapes), TVs, VCRs, or tape decks in the same room when you use the eraser as it has an effective "demagnetizing radius" of around 10 feet. It will "screw up" your TV's color and possibly "magnetize" your VCR and cassette tape heads.

Follow the directions with the eraser and all will be well.

Ken Simmons
Auburn, WA

#3 There are two ways to easily erase a lot of audio and video tapes. All you need is a powerful magnet.

Computer centers that deal with reels of tape use a device called a "Bulk Tape Eraser." You can purchase one through any good computer outlet, or just do a search on the web. Even RadioShack sells one.

Bulk tape erasers are AC-powered devices that are simply a special transformer activated by a push-button switch on the handle.

Below are some links; one to a chart showing models and how much Gauss you need to do a good job of erasing, the other site will tell you how to build one.

The other option is to use very powerful permanent magnets. You could probably pick up a couple of those 25-pound pull magnets at the hardware store, position them across from each other and move the tapes in-between them.

Benjamin Bulk Tape Eraser Models and a chart showing how much Gauss is required to erase different media: **www.benjaminsweb.com/gscbenjamin/specs.htm**.

Building A Bulk Tape Eraser: **www.repairfaq.org/REPAIR/F_audiofaq2.html#AUDIOFAQ_007**.

Randy Boettjer
Oak View, CA

TECH FORUM

ANSWERS TO 2015 - FEB. 2001

I service a lot of equipment that uses MOVs and transzorbs. I have yet to find an effective way to test them in the circuit.

What is the best way to check the condition of a transzorb?

#1 The simple (and unsatisfying) answer is do not test these devices in circuit. The devices protect circuits from overstress, so you must apply an overstress to test the device.

If the device is dead, then you take out the circuit it was supposed to protect. The devices are robust, so failures are rare. If you suspect one failed, then remove it and test it (or just replace it).

Even if the MOV works, you may destroy the circuit. Overvoltage protection circuits do not defend against all possible faults, and even modest protection often costs too much. (Standler has written a book on the subject.) Many protection circuits just improve the chances of survival. Even if the MOV works properly, an in-circuit test might destroy the circuit.

Testing these devices requires more than a VOM. They are designed to clamp huge power levels but only for a short time. To make sure a device works, we might have to apply 25A and make sure the voltage stays below 30V. The simple answer is do not test them.

Gerald Roylance
Mountain View, CA

#2 MOVs and Transzorbs find their way into just about everything electronic. As you know, they both are used as surge clamps. However, the dynamic properties of each type are different.

MOVs are a non-linear resistor. When they fry, they are easy to identify as bad. However, MOVs exhibit a property whereby their clamping voltages rise as they are exercised at a power level below their destruction threshold. In other words, an MOV rated to fire at 150V minimum may, after the span of several years of exposure to transients, now actually not fire into conduction until the transient reaches 600 or even 1,000 volts. The main advantage of MOVs is they do handle respectable power levels for their size, and they are relatively cheap.

Our standard practice in our shop (we repair electric utility control equipment) is to replace all MOVs in an item that comes in for repair.

A Transzorb is a silicon avalanche diode device. Similar in action to a zener, they clamp very fast. (A zener is a poor transient protector, it can't go into conduction quick enough to keep up with the transient waveform, and will self-destruct.) Transzorbs only fail "open" if they physically blow apart. Therefore, a simple ohmmeter check can tell if they need replacement.

You could set up a current limited variable voltage supply to individually test the point at which they begin to conduct, but why bother as their failure mode is always a short circuit or at least appreciable leakage.

Their disadvantage is a relatively low power handling capability before they self-destruct. One advantage is that they do short if overloaded, and usually prevent anything from getting past them.

Most commercial surge suppressors use hybrid circuitry that are a combination of Transzorbs and MOVs or Transzorbs and gas tubes.

Phil Shewmaker
Louisville, KY

#3 These devices are usually used as limiters and are placed in parallel with the circuits they are intended to protect.

While it is possible to apply a brief pulse of voltage in parallel with the device being tested, that pulse will also be applied to the protected circuit. This is only okay if the MOV or Transzorb being tested is in good shape and the pulse applied is within its rating. If the part is bad, it won't protect the rest of the gear as was intended, and the test may cause damage to the rest of the equipment.

The only safe and accurate way to test requires disconnecting at least one lead of the device from the rest of the circuit. Then it can be tested at low current for the specified breakdown voltage (usually about 1mA is used). Or one can apply a brief pulse of high current and capture the peak voltage at which the device limits. This means a pulse of about 10 to 100 microseconds, so a storage scope with suitable probe or a sample-hold (S/H) circuit is needed.

The sample-hold circuit will need a voltage divider between the tested device and the S/H, 100:1 would be good. A simple pulse source would be 100 ohms in series with a 0.47 microfarad film-and-foil capacitor. It would be charged via the common terminal of a SPDT relay. The NC contact would go through a high-value resistor to an isolated variable high-voltage DC supply; the NO contact would go to the device under test. Operating the relay would discharge the R-C circuit into the MOV. Any such high-voltage testing should be done with the equipment disconnected from the power source.

All tester circuits, whether low current or pulse, should be of an isolated design, so that any ground, such as the scope ground is not shorting any part of the tester. Also take the usual precautions when working with high voltages.

If this sounds like a lot of trouble, it is. In the case of Transzorbs or other brands of zener-type devices, they usually fail to a shorted condition, unless there's enough energy available to burn them up. It's very hard to make one go open without visible or smellable damage. If a Transzorb doesn't look bad and is not shorted, it's probably still good.

MOVs can fail with visible damage, but they also have a long-term, gradual failure mode where they become less effective with time and eventually either looks like an open circuit or do not limit as well as needed. They are usually cheap enough to replace as a preventive measure, especially if the gear has been in operation a long time.

So as a practical matter, it may be easier to replace MOVs as matter of preventive maintenance; Transzorbs will only get replaced if shorted (easily checked in-circuit) and can probably be left alone if not shorted or visibly damaged.

Jonathan Wexler
Los Angeles, CA

ANSWERS TO 2018 - FEB. 2001

I started a project to construct a light control circuit (to light one bulb and then the other).

The circuit's control a pair of MOSFETs number IR9510. I need to find a source to purchase from.

I have researched a number of warehouses without success. Can someone help?

#1 The IR9510 is a P-channel Hexfet with 100V Vdss (drain to source voltage), 1.2 ohms RDSon (On resistance), and 4 amps Id (drain current). Vgs is 10V (this is the gate voltage needed to achieve the stated RDSon).

Specifications are at: **irplus.irf.com/JNuI6a6c/search/param-search/param-fam.4.html?PART_ID=2117**.

The voltages and currents are listed as negative in the specification because they are relative to the source terminal.

In a circuit, the gate and drain of a P-channel FET will be negative with respect to the source.

For your application of turning on a light bulb, any number of P-Channel enhancement mode FETs would work fine. The substitute part's Vdss rating is larger than your power supply voltage (by a reasonable margin).

The RDSon and Vgs of the substitute should be equal or lower than the IR9510, and the Ids should be equal or higher.

To locate a substitute, check **Electronics Goldmine www.goldmine-elec.com**/ or **All Electronics www.allcorp.com/**.

You can also order the IR9510 from **Digi-Key www.digikey.com/** and other electronic distributors.

Tim Godfrey
via Internet

#2 If the MOSFET you are looking for is actually part number IRF9510, a 3 amp 100V P-channel MOSFET in a TO-220AB package, then you can find them as catalog number 570-IRF9510 for $1.25 each at **Mouser Electronics 1-800-346-6873**, website: **www.mouser.com**, email sales@mouser.com.

Jack Dennon
Warrenton, OR

ANSWERS TO 2016 - FEB. 2001

I have a couple of fixed-sync computer monitors.

I know that a couple of years ago, dealers were selling these monitors, modifying the scan rate to be compatible with standard VGA cards.

Does anyone know detailed instructions on how to modify these monitors for VGA use?

#1 Changing the scan frequency of fixed frequency monitors is not a sure thing. Whether it is possible depends on a number of factors specific to the monitor.

The horizontal deflection circuit in a monitor is a resonant circuit. The yoke is the inductor and there are one or more capacitors that set the resonant frequency. By adjusting the value of the capacitor, some change in the operating frequency is possible. There are often resistor/capacitor networks involved to control the linearity of the sweep, and modifying these networks gets to be complicated.

I have done conversions of 25KHz monitors to 31.5KHz before, but I had a schematic. It would be an extremely difficult job without a schematic.

Most vendors that sell fixed frequency monitors for PCs supply a special video card that generates a fixed frequency video signal compatible with the monitor.

Since you say you are not a video technician, this is the route I would recommend.

Two companies that offer fixed frequency video cards are: **Photon www.photonweb.com/** and **Mirage www.mirage-mmc.com**.

Also see this FAQ in using fixed frequency monitors on PCs: **www.repairfaq.org/sam/ffmon.htm**.

Tim Godfrey
via Internet

#2 Rather than modifying the scan rate of the fixed frequency monitors, the companies selling those monitors included a PC-compatible video card providing the appropriate signals to drive them.

Tom Trebisky has a number FAQs and links relating to fixed frequency monitors and their use with PCs at **http://kofa.as.arizona.edu/places.html**.

One company providing complete solutions (video cards and cables) for using fixed frequency monitors with PC or MAC compatible systems is **Software Integrators www.si87.com**.

Other sources include: **Photon www.photonweb.com**, and **Mirage-Multimedia www.mirage-mmc.com/core.html**.

Greg Werstiuk
via Internet

TECH FORUM

ANSWERS TO 2019 - FEB. 2001

I need a circuit for hooking two telephones together for demonstrations. Must also be able to activate ringer.

#1 Viking makes a neat unit for testing/demonstrating telephones. I have been using their DLE200B DemoLine Telephone Line Simulator for many years to test phones and modems.

The unit has two modular phone jacks on the front. To use the unit, just plug a phone in each of the jacks. Pick up either phone and the other one rings. The only drawback is that it is kind of pricey at $125.00. One source is **Jensen Tools, www.jensentools.com**.

In their catalog 211, Jameco also offers two versions of a Quicklink automatic ring down unit. The description sounds like it does the same thing, but it's not packaged as neatly and requires a separate power supply. (These are Quicklink part number E002 and S002.)

James J. Schmidt
Deer Lodge, MT

#2 Providing the ringing signal as you imply, is the tough part. If not for that requirement, you could do it all with a nine-volt battery across the tip and ring.

On page 177 of his book *Ready-to-Build Telephone Enhancements*, ISBN 0-8306-4359-1, Delton T. Horn has a diagram for a 110-volt AC-powered circuit based primarily on a power transformer with 18-volt secondary with the output half-wave filtered and then dropped down to 12 volts through a 7812 type regulator to create +12 volts which is connected to the "tip" (the green wire).

The ground side of the regulator is connected to the "ring" (the red wire).

The tip and ring each get a series 470 ohm, 5 watt resistor.

Signal to activate the ringer in the phones is obtained by dividing down a voltage tapped off the hot side of the AC line, through a fuse, of course. Also, 60 Hz may not well ring some oldtime bell clangors that are mechanically tuned for 20 Hz.

Do treat that AC line will all due respect, and you might want to check the reader reviews for this book at Amazon, as some errata have been posted.

For a high-class tester, you can get "Ma Bell in a box." It is catalog number 72-6548 for $229.00 from **MCM Electronics 1-800-543-4330, www.mcmelectronics.com**. Add $150.00 and they will throw in Caller ID signal generation so you can show off modern gadgets, as well as those oldtimers.

You will of course want to check out the *Nuts & Volts* advertiser **Digital Products Company**, who offer the "Ring It! Telco Simulator" in kit form for $169.95, at **1-916-895-7219; www.digitalproductsco.com**. Their box provides genuine 20 Hz ring signal and Caller ID to boot.

Jack Dennon
Warrenton, OR

#3 The talk circuit is child's play. I did it as a child! It is the ring generator that gets more complex. I had some success in the past using just a voltage source (12 to 48 VDC) and an electro-mechanical (NOT solid-state!) relay (coil voltage rated the same as the source voltage) as follows:

-V to "L1"
+V to ground and relay coil
Other end of relay coil to "L2"
Normally-closed contacts of relay, and a normally open push button, in series across "L1" & "L2"

"L1" and "L2" are your phone lines that each phone will go across.

The number of ringers that this will work with varies. Some phones can't be made to ring with this. Any off-hook phone should disable the ring-generator.

How it works: **1.** The coil in series with power and the phone line provides talk power isolated from the power source. A resistor is commonly used in place of the coil, except in old switching equipment. **2.** When all phones are "on hook", the relay coil should get no power until you press the button.When you press the button, the relay energizes, opening the NC contacts, removing power from the coil, closing the contacts. Thus "buzzing" and providing a squarewave that will activate most telephone ringers. The correct 50 cycle ring could be created with a properly selected capacitor across the relay contacts and/or coil.

I am not saying that this will work well. It is just the simplest circuit I know that ever works.

J. D. Arbaugh
Pearblossom, CA

ANSWERS TO #2011 - FEB. 2001

I would like to convert 12VAC to 1VDC without using a transformer to run a very tiny motor at 60 RPM. Using a diode and ceramic resistors has proven useless, as the resistor heats up too much.

The entire thing must mount in no more than 3/4" x 3/4" x 3/4".

#1 What you need is a switching regulator. The resistor you tried to use heated up too much because it is dissipating most of the power in the circuit.

National Semiconductor makes a line of IC switching regulator controllers called "Simple Switchers," that are very efficient, and require a minimum of external parts.

I recommend using an LM2575-Adj **<http://www.national.com/pf/LM/LM2575.html>**.

You need to keep in mind that this regulator will only adjust down to 1.23 volts, so if this is still too high, set the voltage at 1.9 volts, and put a diode in series with your load.

National has software on their site that you can use to pick component values (it's called "switchers made simple"). Digi-Key carries all parts necessary.

Robert Zusman
Scottsdale, AZ

#2 A step-down (or buck) switching regulator will reduce voltage with high-efficiency. You didn't say what the current requirement is, so I can't recommend a specific IC to solve your problem.

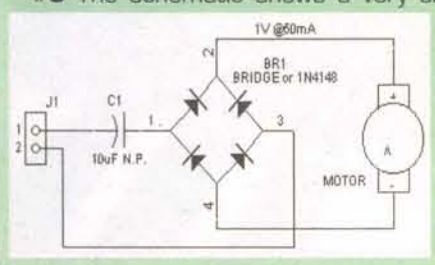
All the chips will require a DC input, so you will need to rectify and filter the 12V AC into DC. Since the regulator's job is to provide a constant output voltage, you don't need to provide extensive filtering. Just be sure the voltage at the regulator input never dips below the dropout voltage.

One chip to look at is the Maxim MAX1745. All Maxim's chips are available in tiny SO packages, so your space limitation won't be an issue.

Linear Technology, Analog Devices, National Semiconductor, and Texas Instruments also make buck regulator chips.

Tim Godfrey
via Internet

#3 The schematic shows a very simple solution for a motor that draws about 50mA. It does not dissipate any heat. The capacitor must be a bi-polar (non-polarized) type. Its value can be scaled up or down for other currents.



Using a Digi-Key #P1176 10uF/25V cap and four 1N4148 diodes, the assembled circuit will easily fit in your confined space.

T. Black
Folsom, CA

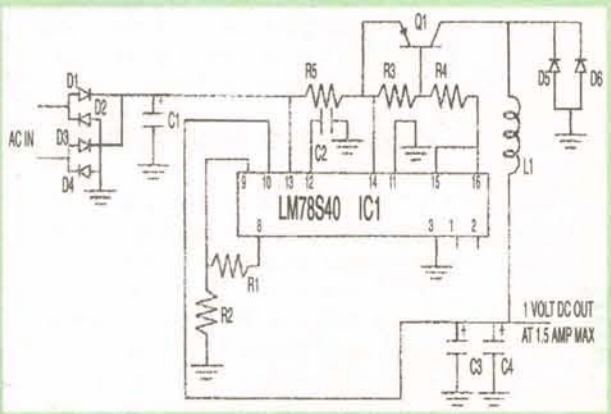
#4 You are not giving much detail, except that you are limited in space. 3/4" x 3/4" x 3/4" is not enough space to build an AC-to-DC converter to run a motor.

Your original attempt was logical, but not practical. You were trying to drop more than 90% of the power in your series resistor diode combination. If your motor draws 0.5W, which is probably typical for a small motor, your power dissipation in the resistor would have been almost 10 times the motor power. Now you understand why your resistor got very hot.

It sounds to me that you have the wrong motor for this application. You probably derived to the 1 VDC by lowering the motor voltage until you got your desired speed of 60 RPM. What you need is to find a 12V geared motor. These motors are small and very common in mechanical timers and clock applications. Check out Digi-Key or similar catalogs.

Haim Sandel
Scottsdale, AZ

#5 You need a switching regulator. If you are drawing over one amp, I don't know any commercial units that are that small, or go as low as one volt. This design could fit, volume-wise, but it is tight. If you put twp PC boards in the 3/4 x 3/4 box, there is 1.125 square inches available.



The parts listed below take up to 0.67 square inches. Experience tells me that the layout is feasible. These are all surface mount except R4. Using a jumper for R5 eliminates short circuit protection.

Russell Kincaid
Milford, NH

Part	Value	Digi-Key number	Cost (total)	Foot Print (total)
D1,D2,D3,D4	1A, diode	ZHCS1000CT-ND	4.80	.04 SQ. IN
D5,D6	3A, diode	MA1005CT-ND	1.68	.03
R1	300 ohms, .1W	P300CCT-ND	.90	.002
R2	1.2k, .1W	P1.21KCCT-ND	.90	.002
R3	100 ohms, .1W	P100ACT-ND	.80	.002
R4	50 ohms, 1W	41R50R-ND	1.88	.03
R5	.11 ohms	use jumper		
C1	470uF	PCE3184CT-ND	.59	.07
C2	.022uF	PCC223BGCT-ND	.14	.004
C3,C4	68uF	PCS1686CT-ND	27.06	.04
L1	22uH	M9753CT-ND	5.45	.20
Q1	PNP, 3A	FCX1151ACT-ND	1.05	.04
IC1	SW REG	LM78S40N-ND	4.50	.21
		TOTALS	$49.75	0.67 SQ. IN

MINI MIDI MONITOR — Part 1

by Robert Lang

INTRODUCTION

If you use RS-232 or Musical Instrument Digital Interface (MIDI) data links, this project will give you a useful addition to your toolkit that has not been available in the past. MIDI data links are used to control musical synthesizers and other musical equipment from computers and are described in Source 1 (listed in the Sources sidebar).

The MINI MIDI MONITOR (MMM) can accept RS-232 or MIDI data and display the data in hexadecimal or interpreted format. There is a MIDI option to filter out MIDI running status bytes. I have not been able to find such a dual purpose device available in the commercial world, so I decided to build one from scratch — and you can too!

The goals of this project are to build a device that will:

1. Decode MIDI serial data and display MIDI messages in plain English.

2. Do double duty as a high speed ASCII display.

3. Have IN and OUT connectors so it can sit invisibly and monitor data between any data source and sink.

4. Cost less than $50.00 to build.

5. Have a large readout for those 1960 musicians who now wear bi-focals.

6. Run on a battery or five-volt power supply.

MMM recognizes many types of MIDI commands as shown in Table 1. An example of the interpreted MIDI output is given in Figure 1. The message displayed is a "note on" command on channel 1 for an octave 4 A# with a velocity of 64. The equivalent hexadecimal display is shown in Figure 2. With a simple change of the switch settings, you are ready to display ASCII data as in Figure 6.

CHOOSING THE CHIPS

Initially, the project was to be built around the Microchip 16F84 peripheral interface controller (PIC), but when I started testing, I found that a 4MHz chip could not keep up with the 31,250 serial baud rate of MIDI data. I also decided to use interrupts to avoid data loss. I decided on the Microchip16F873 running at 4MHz from Source 2. The chip was economical ($7.00), had 4K of re-programmable program memory, was programmable in-circuit, and had a built-in serial port. A 16F873 chip, preprogrammed with the MINI MIDI MONITOR software, is available from Source 3.

The other big chip in the circuit is the Maxim 233 RS-232 interface chip which is available from Source 5. This chip produces the ±12 volts needed for an RS-232 circuit from a single +5 volt supply. The Maxim 233 is also nice because it does not require any large external capacitors.

The LCD display was a 20-character backlit LCD module with 1/2" high letters. The unit costs $9.95 from Source 4 and comes with complete documentation. There appear to be many of these LCD modules using compatible controllers that accept parallel input and have three control lines. Some of the compatible controllers are Samsung KS0066, Hitachi HD44780, and Sanyo LC7985NA.

CIRCUITRY

As shown in Figure 3, the circuit receives two types of serial data: MIDI and RS-232. The MIDI input connector is a DIN-5 socket and the RS-232 connector is a DB-9 socket. The MIDI signal is routed

Figure 1. MINI MIDI MONITOR Display

Figure 2. MMM Hexadecimal Display

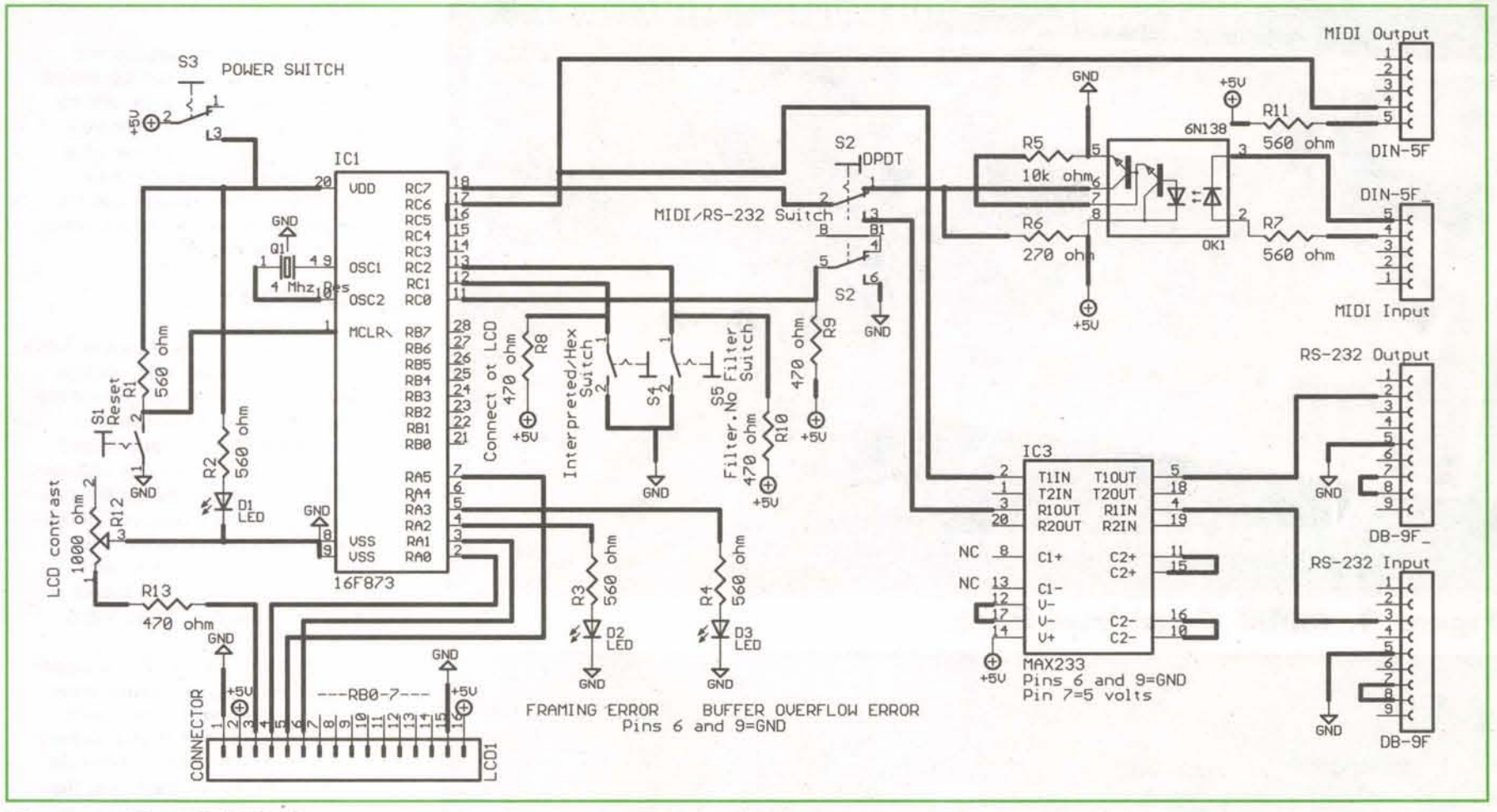


Figure 3. MMM Schematic

through a 6N139 optical isolator which converts it to 0-5 volts. The RS-232 signal is routed through the MAXIM 233 chip which converts it to 0-5 volts. Switch S2 selects MIDI or RS-232 serial input and connects the signal to the 16F873 serial input pin 18 (RC7). S2 also provides +5 volts to RC0 if MIDI is selected, and 0 volts if RS-232 is selected.

Switches S4 and S5 are used as user input switches. They apply +5 volts to 16F873 pins 12 (RC1) or 13 (RC2) if the input serial data is to be interpreted or MIDI active sensing status bytes are to be filtered out. Pins 4 (RA2) and 5 (RA3) are connected to FRAMING ERROR and BUFFER OVERFLOW ERROR red LEDs. Pin 1 on the 16F873 chip is connected to a red momentary contact switch, S1. Pressing this switch causes all errors to be cleared and the 16F873 program to be restarted.

Pin 17 (RC6) passes the data received on pin 18 on through to the MIDI and RS-232 output circuits. S3 is the main power switch and D1 is a red power indicator LED. Power comes from a 6.5 volt AC wall wart and is converted to 5 volts DC. Q1 is a 4MHz ceramic oscillator.

The main outputs of the 16F873 chip are the eight bits of the B port (pins 21-28) which pass data back and forth to the LCD. There are also three control lines used with the LCD. Pin 2 (RA0) is the command/data control line. If the line is low, then the information on RB0-7 is interpreted as an LCD command (like ERASE). If it is high, the information on RB0-7 is interpreted as data (like a character to display). Pin 3 (RA1) is the enable line which must be pulsed to have the LCD accept or return data on RB0-7. Finally Pin 7 (RA5) controls the data direction of the LCD display. If Pin 7 is high, then data is read from the LCD (like the BUSY bit). If Pin 7 is low, then the data is sent to the LCD.

BUILDING THE CASE

A very nice little case can be constructed for about $1.00 out of white styrene plastic. The material is available in hobby shops, but a much more economical source for styrene plastic is a local sign shop. They carry a white styrene sign-making plastic which is 0.06" thick. About a square foot is needed for the case. The dimensions of the case are 7-1/2" wide, 2-1/2" tall, and 2-1/2" deep.

The pieces were cut out of the plastic. Note that there is a 1-1/8" x 6-1/2" window in the front panel for the LCD readout. The pieces were cut from the sheet by first scoring with an Xacto® knife and then snapping along the line.

PART	DESCRIPTION	SOURCE
IC1	16F873 8-bit CMOS FLASH microcontroller	2
	Preprogrammed 16F873	3
Q1	4MHz ceramic oscillator	2
IC2	6N138 high-speed optical isolator	5
IC3	MAX233 RS-232 interface chip	5
R8,9,10,13	Resistor network 470 ohm	5
R12	1000 ohm trimmer potentiometer	5
R5	10k ohm 1/4 watt resistor	5
R1,2,3,4,7,11	560 ohm 1/4 watt resistors	5
R6	270 ohm 1/4 watt resistor	5
S1	Momentary contact push-button switch	5
S2	DPDT switch	5
S3,4,5	SPST switches	5
D1,2,3	5-volt red LEDs	5
LCD1	20 character LCD module with 1/2" high characters	4
MISC	Breadboard 6.5"x1.375", 630 points	5
	22 AWG solid wire	5
	2 DB-9 female connectors	5
	2 DIN-5 female connectors	5

Table 2 — MINI MIDI MONITOR Parts List

HEXADECIMAL	INTERPRETED	MEANING
81 39 64	NOTEOFF CH#1 4A V64	Note-off on MIDI Channel #1 for forth octave A with velocity 64
92 3A 64	NOTE ON CH#2 4A# V64	Note-on on MIDI Channel #2 for forth octave A# with velocity 64
91 39 00	NOTE ON CH#1 4A V00	This is an alternate way to turn a note off by sending a Note-on with velocity of zero.
Ax 12 34	UNKNOWN 1234	Poly key pressure is not implemented
B4 07 25	CTRL CHG CH#4 25	A controller change for controller 7 to a value of 25. Controller 7 is the volume controller so this would set the volume for MIDI channel 4 to 25.
CA 06	PATCH CHG CH#A 06	Instrument change on MIDI channel A (10) to 06. The general MIDI specification says that instrument 6 is a harpsichord so this command will switch the instrument on channel 10 to a harpsichord.
Dx 56	UNKNOWN 56	Overall key pressure is not implemented
EF 00 7F	PITCHBEND 00 7F	Pitch bend on MIDI channel F (15) to a value of 7F00. This will cause a pitch bend on channel 15 of almost a full step upward.
FF 41 38	SYSTEM MESSAGE 4138	Any command that begins with F is a system status message. The data bytes associated with the message, if any, are just displayed. Note that FE, MIDI active sensing messages, can be filtered out.

Table 1 — Examples of MIDI Hexadecimal and Interpreted Data

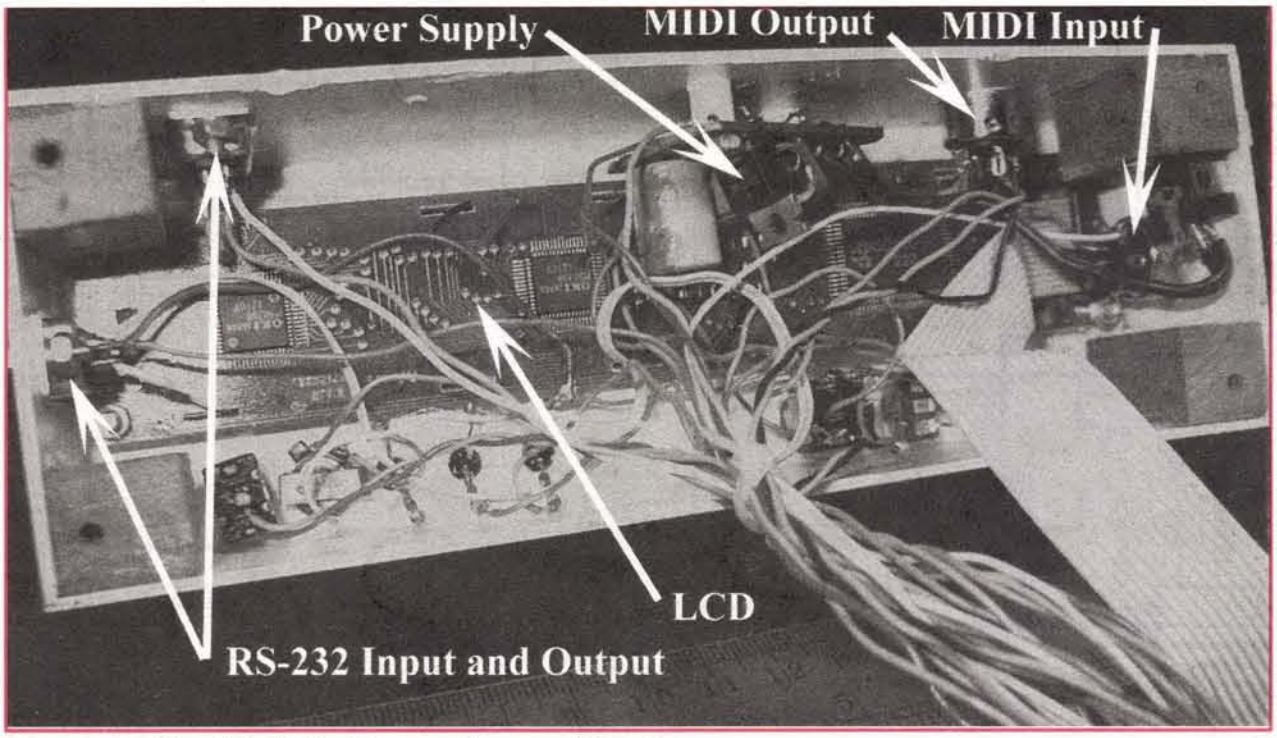


Figure 4. MMM Case from Back

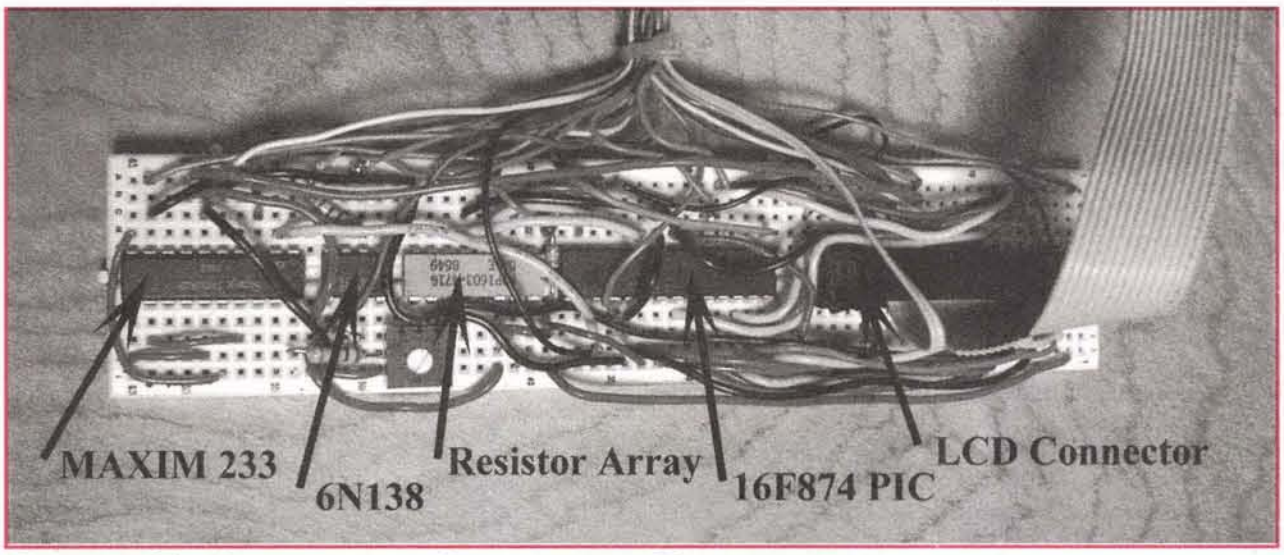


Figure 5. Completed Circuit on Breadboard

Holes can be drilled with a power drill or hand drill.

Actually, the plastic is soft enough that a hole can be drilled by just hand-twisting the drill bit into the plastic. Assembly was done using styrene plastic glue which forms a weld of plastic. Small bits of wood were used to reinforce the corners of the case as shown in Figure 4.

ASSEMBLY

The parts list is shown in Table 2. I decided to use a 63 column solderless breadboard to build the unit. I did this for two reasons. First, the solderless breadboard would accommodate any changes I decided to make during the prototyping process. Second, all the parts could be re-used in the future. The connections were made on the solderless breadboard as shown in Table 3 and Figure 3.

Begin by placing the integrated circuits and the resistor array on the breadboard. Then make connections to the 16-pin connector to the LCD module. Add connections to the switches and the LEDs. Then add connections to the DIN-5 MIDI and DB-9 RS-232 sockets. Finally, add the power connections. The completed circuit on the breadboard is shown in Figure 5.

TESTING

Note that when you turn on the MMM, only the D1 power LED and LCD backlight come on. That is because the 16F873 has not yet been programmed. The programming of the 16F83 is covered in Part 2 of this article. Once the 16F873 is programmed, you can begin your testing. It is best to make sure everything is working before placing the breadboard in the case.

When the power is turned on, the power LED should light. Then the FRAMING ERROR and

SOURCES

Source 1 *Advanced MIDI Users Guide* by R. A. Penfold, PC Publishing, 1995
pcp@cix.compulink.co.uk

Source 2 Peter Anderson
www.phanderson.com

Source 3 MIDIMON homepage
www2.netdoor.com/~rlang/mmm/mmm.htm

Source 4 Marlin P. Jones & Associates, Inc.
See their ad on Page 4
www.mpja.com

Source 5 Jameco, Inc.
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BUFFER OVERFLOW ERROR LEDS should each light for one second. Next, the switch settings will be displayed in the LCD. First "MIDI" or "RS-232" will be displayed based on switch S2's setting. Next, "HEXADECIMAL" or "INTERPRETED" will display based on switch S4's setting. Next, "FILTER ON" or "FILTER OFF" will display based on switch S5's setting.

At this point, the switch settings are locked in and will not be read again until the RESET button is pressed. Finally, "MINI MIDI MONITOR OK" will be displayed as in Figure 6. When the screen is erased, the monitor is ready to receive and display data.

The unit was tested with RS-232 data being transmitted continuously at 19,200 baud. When the data was being displayed as interpreted data, a buffer overflow took place after about 2,500 characters. When the data was being displayed as hexadecimal, the overflow took place at about 800 characters.

Because MIDI data is not usually transmitted continuously, but is transmitted in bursts whenever a note must be played or a patch changed, I cannot give you anything but a general idea of performance. I connected the unit to a computer and played Mozart's Alla Turca, a rather quick-paced march, and there was no buffer overflow.

Figure 6. Operational MMM Displaying Interpreted RS-232

REGISTER/ BIT	INPUT OR OUTPUT	DESCRIPTION	PIC16F873 PIN	LCD MODULE PIN
A0	O	LCD MODE: 0=COMMAND, 1=DATA	2	4
A1	O	LCD ENABLE PULSE	3	6
A2	O	SERIAL FRAMING ERROR	4	LED2
A3	O	BUFFER OVERFLOW ERROR	5	LED3
A4	O	Open drain don't use		
A5	O	LCD READ/WRITE 0=WRITE,1=READ	7	5
B0	O	Output to LCD	21	7
B1	O	Output to LCD	22	8
B2	O	Output to LCD	23	9
B3	O	Output to LCD	24	10
B4	O	Output to LCD	25	11
B5	O	Output to LCD	26	12
B6	O	Output to LCD	27	13
B7	I/O	Input/Output to LCD (LCD BUSY BIT)	28	14
C0	I	SERIAL MODE: 0=RS-232, 1=MIDI	11	½ SWITCH2 DPDT
C1	I	DISPLAY MODE: 0=HEX, 1=ASCII/ INTERPRETED	12	SWITCH4 SPST
C2	I	MIDI RUNNING STATUS FILTER: 0=NO, 1=YES	13	SWITCH5 SPST
C3	I	Unused	14	
C4	I	Unused	15	
C5	I	Unused	16	
C6	O	Serial Transmit	17	½ SWITCH2 DPDT
C7	I	Serial Receive	18	
MASTER RESET			1	SWITCH1 Momentary contact

Table 3 – PIC 16F873 Data Connections

TO ASSEMBLE OR NOT TO ASSEMBLE

With any project that involves a PIC, the builder must decide in which language to program. Assembly language has several benefits:

- **Price.** The MICROPIC assembly language is free.
- **Speed.** Assembly language programs are generally the fastest programs around.
- **Space.** Assembly language programs are often the smallest.
- **Capability.** You can do things in assembly which are difficult or impossible in high level languages (HLL).

Assembly language is the uncontested speed champion among programming languages. An expert assembly language programmer will almost always produce a faster program than an expert C programmer and certainly faster than an interpreted language like BASIC.

The Microchip 16F873 PIC has 4,096 words of program memory. Because of this limitation, the memory should be used efficiently. Assembly language programs are often less than one-half the size of comparable HLL programs.

Capability is another reason people resort to assembly language. High-level languages are designed to be independent of the particular machine architecture. As a result, they rarely take into account any special features of the machine, features which are available to assembly language programmers.

With assembly language, since it is so machine specific, you have access to the inner-most workings of the machine. One of the areas that cries out for assembly language is interrupt processing. Anything you can do on the machine you can do in assembly language. This is definitely not the case with most HLLs.

CONCLUSION

The hardware has been constructed for the MINI MIDI MONITOR and I have decided to use assembly language to program the Microchip 16F873. In the final part of the article, I will cover the writing of the program and how to program the 16F873. **NV**

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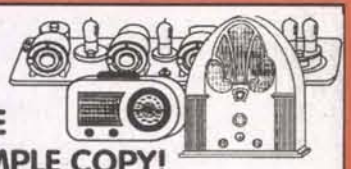

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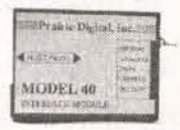

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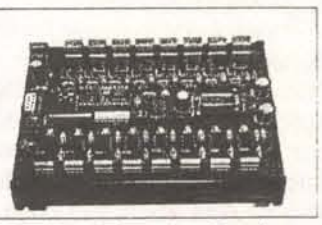

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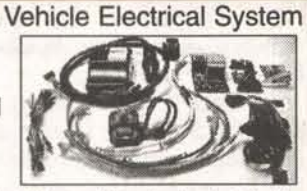

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CONTINUED FROM PAGE 13

www.telecruz.com.

VHB TECHNOLOGIES STOPS HACKERS COLD – CONTENT-INTELLIGENT APPLIANCE KEEPS ATTACKS FROM CLOGGING NETWORK

When hackers launch Denial-of-Service (DoS) or Distributed-Denial-of-Service (DDoS) attacks over the Internet, VHB Technologies, Inc. (www.vhbtech.com), halts the onslaught at the wide area network (WAN) level before it clogs local customers' networks, preventing service disruption.

"Current approaches of constructing a defense system at the customer's site are absolutely useless if the hacker has already flooded the customer's Internet link," said Garry L. Hemphill, VHB's CEO, chairman of the board, and co-founder.

"Once the Internet WAN link is clogged, it doesn't matter what kind of security software or hardware has been installed locally, because Internet service already has been disrupted. The hackers have won."

Such was the case recently at Microsoft Corp. as reported by the press. According to Hemphill, an analysis of those DoS attacks showed hackers were able to flood Microsoft's front door routers at the company's DNS location, causing loss of Internet service to Microsoft's customers.

VHB has the answer for Internet Service Providers (ISPs) like Microsoft. It is a content intelligent appliance called the VHB-2000™ that can be installed on the Internet backbone because it is capable of filtering data, voice, and video at extremely high speeds. Unlike current security and data management solutions, which dramatically slow down high-performance networks, the VHB-2000 protects high-speed infrastructures without compromising performance.

Once installed on the Internet backbone, the VHB-2000 simply reroutes DoS or DDoS attacks away from any lower-speed links to enterprises or individual users downstream. After the VHB-2000 detects the anomalies, the appliance instantly shunts it to an auxiliary network or a secure database, known as a "honey-pot," where the data can be examined in more detail to determine the source of the attempted intrusion.

Meanwhile, service continues to all local area networks or web sites connected to the affected Internet pipeline. "End-users or an ISP's customers most likely will never even know their Internet connection was under attack," said Dave Steinman, VHB's director of ISP and federal sales.

The VHB-2000 uses the company's patent-pending VIPRE™ NPU technology (architected to run at 2.5 Gbps) that extracts detailed network traffic information from all seven layers of the OSI stack, allowing for very deep (512 bytes) content searches. Existing solutions, such as ASIC-based Layer 3, 4, or 7 content-aware devices, are not capable of this level of deep content intelligence. **NV**

USING VOLTAGE REFERENCE AND TEMPERATURE SENSOR ICs (Part 3)

by Ray Marston

Ray Marston shows — in this final installment of a three-part series — how to use a further selection of popular 'temperature sensor' ICs.

The first two articles of this three-part mini-series presented practical 'application' information on popular voltage reference ICs, current source ICs, and on three popular temperature sensor ICs manufactured by National Semiconductor. This month's concluding episode gives practical usage information on four popular and widely available temperature sensor ICs manufactured by TelCom Semiconductor.

Miscellaneous Temperature Sensor ICs

Several companies other than National Semiconductor manufacture popular types of temperature sensor ICs. The best known of these is TelCom Semiconductor, who produce four very popular ranges of such devices.

Two of these devices — the TC02 and the TC03 — are precision temperature-to-voltage converter ICs that generate a linearized output voltage that is proportional to the IC's temperature and has a slope of 10mV/°C.

The other two devices — the TC07 and the TC622 — act as presettable thermal switches with complimentary logic-type outputs that change state when the IC's temperature goes above or below preset limits, which can be accurately set via one or two external resistors.

The rest of this article presents practical usage information on these four devices.

The TC02 and TC03 (TelCom Semiconductor)

The TC02 and TC03 are precision temperature-to-voltage converter ICs that generate a linearized output voltage that is proportional to the IC's temperature and has a slope of 10mV/°C. Figure 1 lists the basic operating parameter details of the two devices.

The TC02 IC is specifically designed for use with a simple single-ended DC supply with an output voltage in the range 3V to 12V, and acts as a precision converter over the -20°C to +125°C temperature range. Its output voltage equals (10mV x °C) + 500mV, and is thus 300mV at -20°C, 750mV at +25°C, and +1500mV at +100°C. Figure 2 shows the basic application circuit of the TC02 IC.

The TC03 IC is specifically designed to generate an output voltage that is directly proportional to temperature at a rate of 10mV per °C, over the -20°C to +100°C temperature range; its output voltage is thus 200mV at -20°C, 250mV at +25°C, and +1000mV at +100°C. Figure 3 shows the IC's basic application circuits. If the IC is to be used only at temperatures within the range 0°C to +100°C, the simple single-ended circuit of Figure 3(a) can be used, but if it is to be used at temperatures down to 20°C, the dual-supply circuit of Figure 3(b) must be used. In the latter case, the negative supply rail (V-) needs a value of at least -1.5V, and bias resistor R1 needs a value (in kilohms) of 20 x the V- value, e.g., 30k at a V- value of -1.5V, or 90k at -4.5V.

Parameter	TC02	TC03
Supply voltage range	3.0V to 12V	2.2V to 12V
Supply current (typ.)	40µA	40µA
Output source current (max.)	1mA	1mA
Thermal range	-20°C to +125°C	-20°C to +100°C
O/P voltage at -20°C	+300mV	-200mV
O/P voltage at +25°C	+750mV	+250mV
O/P voltage at +100°C	+1500mV	+1000mV
Non-linearity	±0.8°C	±0.8°C
Average O/P slope	10mV/°C	10mV/°C

Figure 1. Basic operating parameter values of the TC02 and TC03 temperature sensor ICs.

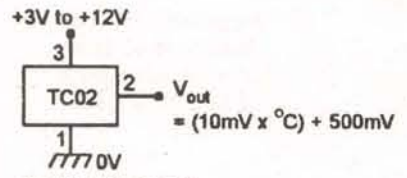


Figure 2. Basic TC02 application circuit.

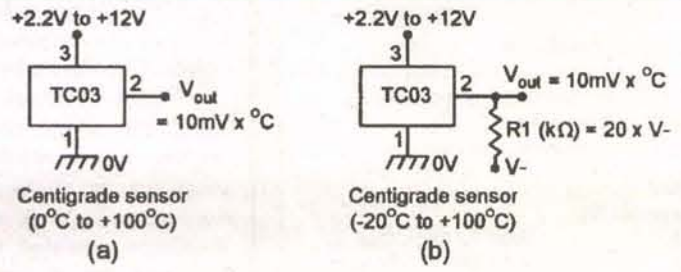


Figure 3. Basic TC03 application circuits (see text).

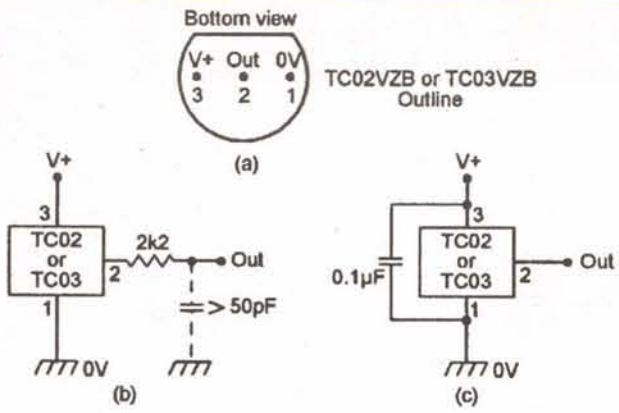
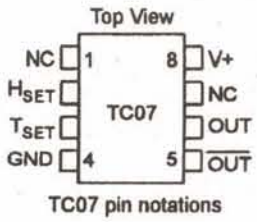


Figure 4. Additional TC02/03 usage data (see text).

Part No.	Package	Temp. Range
TC07COA	8-pin SOIC	0°C to +70°C
TC07CUA	8-pin MSOP	0°C to +70°C
TC07EOA	8-pin SOIC	-40°C to +85°C
TC07EUA	8-pin MSOP	-40°C to +85°C
TC07VOA	8-pin SOIC	-40°C to +125°C
TC07VUA	8-pin MSOP	-40°C to +125°C

TC07 type-number coding



TC07 pin notations

Figure 5. TC07 type-number coding and pin notations.

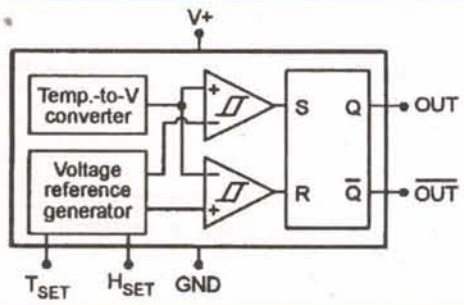


Figure 6. Block diagram of the internal circuitry of the TC07 IC.

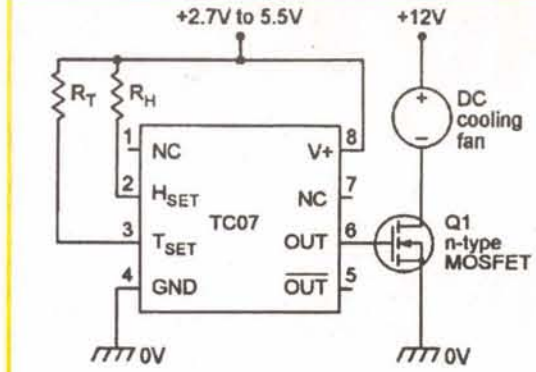


Figure 7. TC07 IC used as an automatic cooling fan controller.

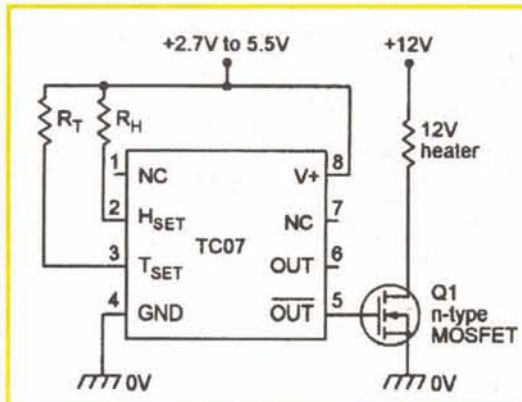


Figure 8. TC07 IC used as an automatic 12V heater controller.

The TC02 and TC03 are widely available in a TO-92 packaging style, in which case their device numbers carry a 'VZB' suffix, as indicated in the package outline diagram of Figure 4(a). When using the TC02 or TC03, note that they have a very limited ability to drive capacitive loads. If they are used to drive loads greater than 50pF (between the output and ground), wire a 2k2 or greater resistor in series with the IC's output, as shown in Figure 4(b). If the IC is used in an electrically noisy environment, wire a 0.1µF decoupling capacitor between the IC's V+ and GND pins, as shown in Figure 4(c).

The TC07 (TelCom Semiconductor)

The TC07 IC is a resistor-programmable solid-state thermal switch with complimentary logic-type outputs; it is designed to be powered from a 2.7V to 5.5V DC supply and consumes a typical quiescent operating current of 130µA. The device is intended mainly for use as an automatic temperature controller in power supply units and computers, etc., and its trip (activating) temperature and hysteresis value (deactivating temperature) can each be set ('programmed') via a single external resistor.

The TC07 is produced in two different eight-pin packaging styles (SOIC and MSOP), each with an option of three different temperature operating ranges. The TC07 is thus available in a total of six sub-variants, each denoted by a three-letter suffix to the basic TC07 part number, as shown in the table in Figure 5, which also shows the pin notations that apply to the TC07.

Figure 6 shows — in block diagram form — the basic internal circuitry of the TC07. The IC houses a temperature-to-voltage converter of the basic TC02/03 type, and its output is fed to one input on each of a pair of Schmitt voltage comparators, which each have their other input driven by the output of an externally resistor-controlled dual voltage reference generator. The outputs of the two Schmitts are fed to the inputs of a SET-RESET flip-flop, which provides anti-phase logic-type outputs (Q and not-Q); when the outputs are active; Q is high and not-Q is low. These states are reversed when the outputs are inactive. The basic IC action is such that both outputs become active when the IC temperature exceeds a preset T_{SET} (temperature) value, and remain active until the IC temperature falls below a preset H_{SET} (hysteresis) value, at which point, the outputs become inactive.

Figure 7 shows a basic way of using the TC07 as an automatic cooling fan controller, which activates the fan if the IC temperature exceeds a 'T_{SET}' value determined by R_T. Once activated, the fan remains on until the IC temperature falls below an 'H_{SET}' value determined by resistor R_H. Alternatively, Figure 8

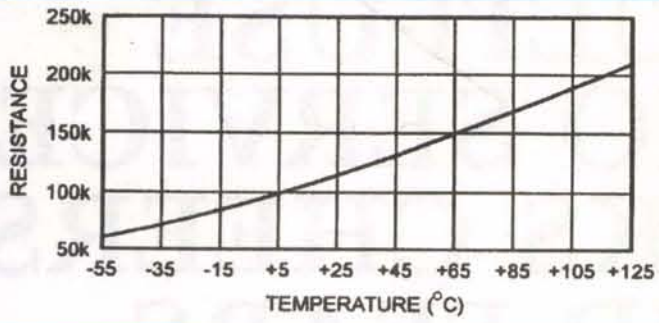


Figure 9. Programming-resistor values vs. °C temperature.

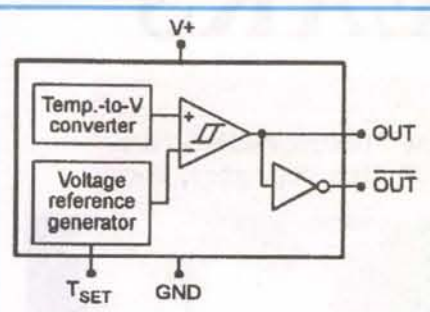


Figure 10. Block diagram of the internal circuitry used in the TC622/624 ICs.

Parameter	TC622EAT	TC622VAT
V+ range	4.5V to 18V	4.5V to 18V
Supply current	200µA typ.	200µA typ.
Temp. range	-40°C to +85°C	-40°C to +125°C
Temp. accuracy	±1°C typ.	±1°C typ.
Trip point hysteresis	2°C	2°C

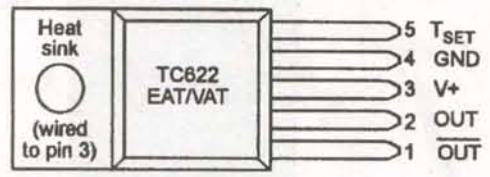


Figure 11. Basic specifications and package details of the TC622EAT/VAT ICs.

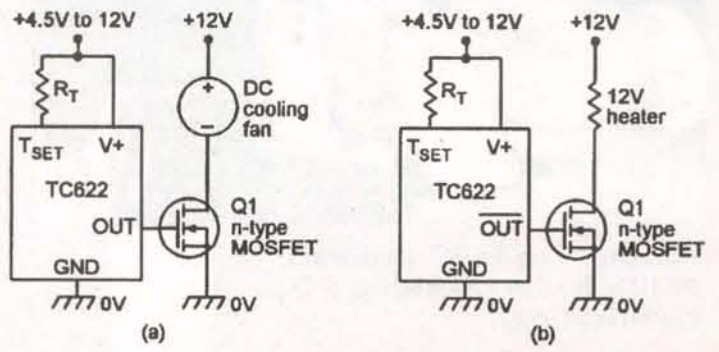


Figure 12. Basic ways of using a TC622 IC to automatically control (a) a cooling fan or (b) a 12V heater.

shows the circuit modified for use as an automatic heater controller, which activates a 12V heater unit if the IC temperature falls below an 'H_{SET}' value determined by resistor R_H. Once activated, the heater remains on until the IC temperature exceeds a 'T_{SET}' value determined by R_T.

The trip temperature values of the TC07 are determined by the values of R_T and R_H, and these values are determined (with a typical precision of ±1%) by the formula:

$$R = 0.6\ (T + 273.15)\ 2.13$$

where R is the required R_T or R_H value in ohms, and T is the required T_{SET} or H_{SET} trip temperature in °C. Thus, for a T_{SET} value of 50°C, R_T needs a value of 132.8k, and for an H_{SET} value of 30°C, R_H needs a value of 115.9k.

As an aid to calculating R_T and R_H values, Figure 9 shows a basic resistance versus temperature graph for the TC07. Note that the graph has a mean slope of 0.85kW/°C over the temperature range 0°C to 100°C. Thus, in the above example (in which H_{SET} is 20°C lower than T_{SET}), R_H must be 17k smaller than R_T. It is important to note that, in the TC07, the H_{SET} temperature must be at least 5°C lower than the T_{SET} temperature value.

The TC622 (TelCom Semiconductor)

The TC622 IC is a dual-output thermal switch in which the trip temperature value can be set via a single external resistor. The device can be regarded as a simplified general-purpose semi-precision version of the TC07 and has a fixed (built-in) thermal hysteresis value of 2°C.

The basic TC622 IC is available in various packaging styles and with a variety of voltage and temperature operating ranges. 'Standard voltage' types can use 4.5V to 18V DC supplies and carry the basic TC622 type number followed by a three-letter suffix that denotes the IC's package style and thermal operating range. 'Low voltage' types can use 2.7V to 4.5V DC supplies and carry a TC624 type number followed by a three-letter suffix that denotes the IC's package style and thermal operating range. A total of 14 sub-variants of the basic TC622/624 IC are available, and all use the same basic internal circuitry, which is shown in block diagram form in Figure 10.

The most popular devices in the TC622 range are the TC622EAT and the TC622VAT, which are each housed in five-pin TO-220 packages with an integral heatsink (which is internally connected to the IC's pin 3 'V+' terminal). Figure 11 shows the basic specifications and package details of these two particular ICs.

The TC622 devices are used in the same basic ways as the TC07 ICs, but without the use of an R_H resistor. Figure 12(a) shows a basic way of using a TC622 IC as an automatic cooling fan controller, which activates the fan if the IC temperature exceeds a 'T_{SET}' value determined by R_T. Once activated, the fan remains on until the IC temperature falls 2°C below the 'T_{SET}' value. Alternatively, Figure 12(b) shows the circuit modified for use as an automatic heater controller, which activates a 12V heater unit if the IC temperature falls 2°C or more below a 'T_{SET}' value determined by R_T. Once activated, the heater remains on until the IC temperature exceeds the 'T_{SET}' value.

Finally, note when using the TC622 IC that the R_T value is determined in exactly the same way as in the case of the TC07 IC, using the formula:

$$R_T = 0.6\ (T + 273.15)\ 2.13$$

as described in the 'TC07' section of this article. **NV**

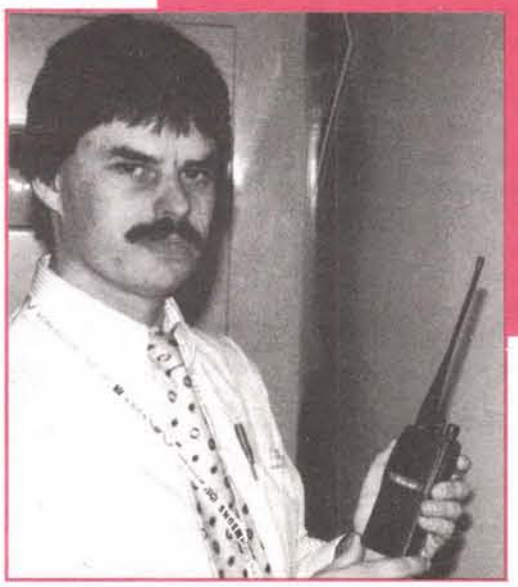
by Gordon West

MULTI-USE RADIO SERVICE SPARKS CHEERS AND FEARS

Maxon "Tru-Talk" two-watt MURS Radio (awaiting FCC certification).

Author West looks at the new Maxon MURS five-channel radio. Maxon will also sell a MURS repeater, too.

Kenwood displays what their MURS radio — under development — may look like.



New Midland MURS radio — will it cut through undisciplined chatter?

It's now on the air — the Federal Communications Commission's (FCC) new Multi-Use Radio Service offering five prime VHF channels with absolutely no licensing requirement.

Portable two-way radio manufacturers are enthusiastic about the prospect of selling thousands of two-watt HTs into this new market. The FCC is pleased that it no longer must enforce licensing rules on those handheld business band radios seen selling at most retail outlets with color-coded frequency "dots." Prospective radio users who needed more than a five-block range from Family Radio Service (FRS) sets are standing in line for the new VHF MURS transceivers that might easily cover an entire city or county with a well-elevated antenna system, or even a several-hundred-mile region if rigged up into a repeater configuration from a high mountain top or building.

The licensed amateur radio community is taking a precautionary "let's wait and see" stance on whether or not this new license-free radio service might positively contribute to license-required amateur radio recruitment, or cause a negative impact on the amateur radio nearby two-meter band where the more savvy MURS no-license user might purchase two-meter 144 MHz-148 MHz linear amplifiers and use them up on the 152 MHz and 154 MHz region with less than a spectrally clean signal, well beyond signal purity and FCC rules banning linear amplifiers from the brand new MURS frequencies.

Amateur operators are also concerned about the new MURS channels that fall under "Citizens Band," and the recent legislation signed by former President Clinton that now

NEW MURS RULES TOO LOOSE?

There is a 30-day official petition reconsideration period that follows any Federal Communications Commission (FCC) Report and Order. The FCC released the MURS Report and Order on October 13, 2000, and within a month both Motorola and the Personal Radio Steering Group announced their concerns that the loose MURS rules could be detrimental to an orderly development of the new multi-use radio service.

Motorola has raised the issue of telephone interconnection by MURS operators. Talk about a long-range cordless telephone — just imagine a two-watt VHF "phone patch" that could let you simultaneously talk and listen over distances of several miles, all from your own home phone. This could probably work for the first year with light MURS frequency loading, but I wouldn't try it myself because someone would probably figure out how to access my MURS phone patch, and start dialing their in-laws in Europe on my nickel. No thank you — I'll stick with my "el cheapo" $49.95 900 MHz phone, thank you!

Motorola is also under possible pressure by present licensed low-power radio users on these existing channels. Motorola suggests that the FCC limit the MURS service strictly for low-power industrial and business radio use.

Motorola may also be concerned that MURS users would integrate their VHF equipment into the UHF Family Radio Service (FRS), and develop some elaborate linking systems not envisioned in the new MURS rules. With such a wide separation of frequencies from 150 MHz to 462 MHz, I could see plenty of crossband applications all in one nice, neat, integrated set. But the FCC, to my knowledge, hasn't officially certified any new MURS radio as of this writing, so quite possibly strict certification rules could prohibit a MURS handheld or mobile radio having capability of the inclusion of a UHF FRS board in it. Or linked to it. Or sandwiched beside it!

While it seems strange that Motorola would like to see the MURS rulemaking halted, Motorola is probably going to be the first with a new five-channel, two-watt, MURS transceiver. Or maybe it will be a four-watt transceiver with a -3 dB short rubber duck antenna, giving out two watts ERP, huh?

The Personal Radio Steering Group, run by Corwin Moore WB8UPM, raises the question that I, too, have been asking, on what the FCC indicates as two watts effective radiated power output. I have been told by Don Henry of Shakespeare Antenna Company that ERP rules are somewhat common for some European seacoast radio systems, and the intent of the FCC rules is to place more attention on no-more-than-two watts ERP at the antenna than power levels at the equipment end of the coax. Shakespeare Antenna Company will carefully analyze the MURS market; and when things settle down, Shakespeare marine antennas at 156 MHz could make some dandy MURS base station white fiberglass antenna systems providing the MURS operator checks out coax losses and power output limits to insure no more than two watts ERP.

And then comes the marketing questions about how different antenna manufacturers rate the gain of their antennas. EIA specs gain over a dipole, dBD. But sometimes we see antenna gains calculated to dBi, gain over an isotropic radiator — two dBi really equating to zero dBD gain on a dipole. Wowsers, I can see some real gain playing when MURS operators begin to calculate what they can do to improve their remote antenna coverage.

The Personal Radio Steering Group also questions the rather lax rules that could allow ham-like base-station-to-base-station communications, ham-like repeater communications, and ham-like phone patch.

The Personal Radio Steering Group is well-respected in all it has tried to do to keep GMRS orderly and in control. Their concern, as well as this author's own concern, is that the extra loose MURS rules published in the FCC Report and Order could lead to city-wide channel chaos, rendering the useful range of MURS handhelds to just a few blocks before someone else's well-elevated phone patch causes capture effect limiting any meaningful increase in range over that of a little, inexpensive, half-watt, FRS UHF unit.

But then again, these five channels have already been taken over by unlicensed users, and maybe some fast food operation already on some of the color dot frequencies will be able to cash in and allow MURS users to radio dispatch the next burger to their home by the local burger wagon monitoring the MURS burger channel. Yes, indeed, the FCC truly needs to study all of the reconsideration comments that ask why the MURS rules have been written so loose.

allows state and local officials to have equal enforcement rights like the FCC to clamp down on any signal that could interfere with your next door neighbor's television, radio, or cordless phone. Licensed hams with little two-meter handheld transceivers don't want to be confused with non-licensed MURS users on an adjacent band of frequencies.

MURS FREQUENCIES:

151.820 MHz	15 kHz sandwich channel
151.880 MHz	15 kHz sandwich channel
151.940 MHz	15 kHz sandwich channel
154.570 MHz	Blue dot low-power channel
154.600 MHz	Green dot low-power channel

NOTE: The three 151.xxx new MURS frequencies were originally assigned to the industrial/business radio service, with a one-watt limitation. The remaining two 154.xxx MURS frequencies were also assigned to the industrial/business radio service, two watts output limitation.

The first three 151.xxx channels are brand new to FRS, and are spaced in between long-time existing business band frequencies 15 kHz higher and 15 kHz lower. These first three MURS 151.xxx channels would be considered "interstitial" to the existing business-band radio users running extremely powerful stations; 15 kHz separation will mean the first three channels could regularly experience "bleed over" from legitimate licensed business-band radio users.

The last two 154.xxx channels are literally packed with radio users right now — some one-watt, low-power, licensed legal users, and a huge number of unlicensed users who purchased "blue dot" and "green dot" handhelds through a mail order catalog or from their local chain store, and never bothered to fill out the appropriate FCC business-band license paperwork. These same channels might also have your local fast food chain barking out orders to the kitchen, and squawking to the drive-thru customers about ketchup or mustard to go along with a large order of fries.

So, we now know that the 151 MHz channels — all three of them — will initially be relatively quiet as opposed to the two 154 MHz channels that are already filled with low-power chatter.

MURS on VHF will outperform FRS on UHF by miles!

SO HOW MUCH POWER?

The new FCC Rule 95.639(g) limits a certified MURS unit not to exceed two watts of effective radiated power (ERP). Each MURS unit must be certified in accordance with FCC Rule 90.203, and no MURS unit will receive official certification if it is somehow capable of any higher power output.

But I question how they are going to accurately measure effective radiated power — think about a handheld, VHF, two-way radio that might put out four watts on a Bird wattmeter, coupled directly to the antenna jack, but the extremely short "rubber duck" antenna resulting in 3 dB loss results in half-power output, or two watts effective radiated power. Since effective radiated power is dependent on antenna gain and coax loss, it seems to me that it is

First Class A CB, then 27MHz, and then GMRS, then FRS, and now MURS!

going to be tough to calculate ERP just by the transceiver alone.

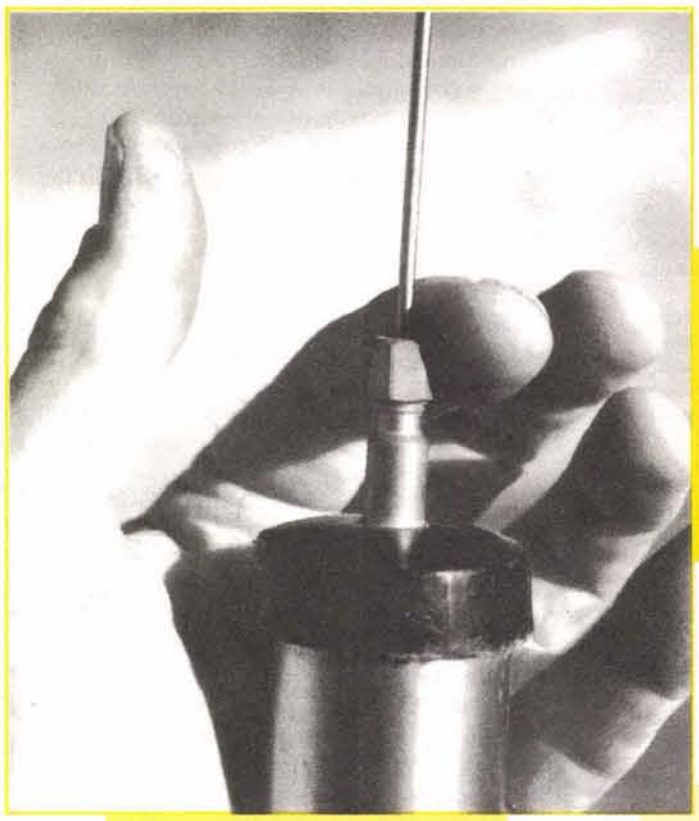
The rules also call for reduced deviation from what we presently hear on the normal 30 kHz separated business band channels. Instead of ±5 kHz of deviation, the rules call for ±2.5 kHz deviation. This will make the audio on MURS equipment sounding dramatically softer if you are scanning both regular business-band channels and MURS channels.

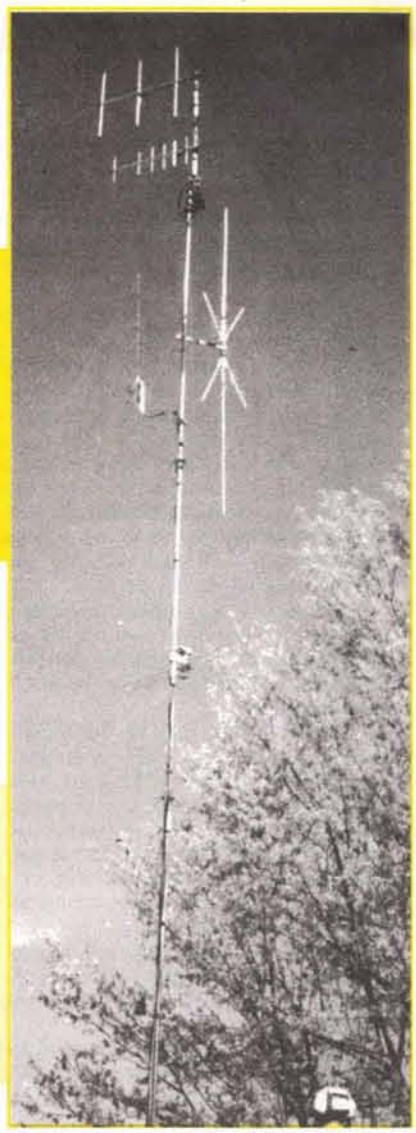
ALL YOU CAN DO

Almost anything goes on the new MURS channels. FCC Rule 95.1307 permits voice, data, slow-scan television, radio control, and zero rules about the content of your messaging. This means you could use MURS equipment to dispatch delivery trucks, gab to other same-channel users about everything and anything, operate your little MURS handheld as a long-range baby monitor (except on 154.600 where no continuous carrier is allowed), or use it as a long-range super cordless telephone. Hooking your MURS radio up to the telephone system is not specifically prohibited.

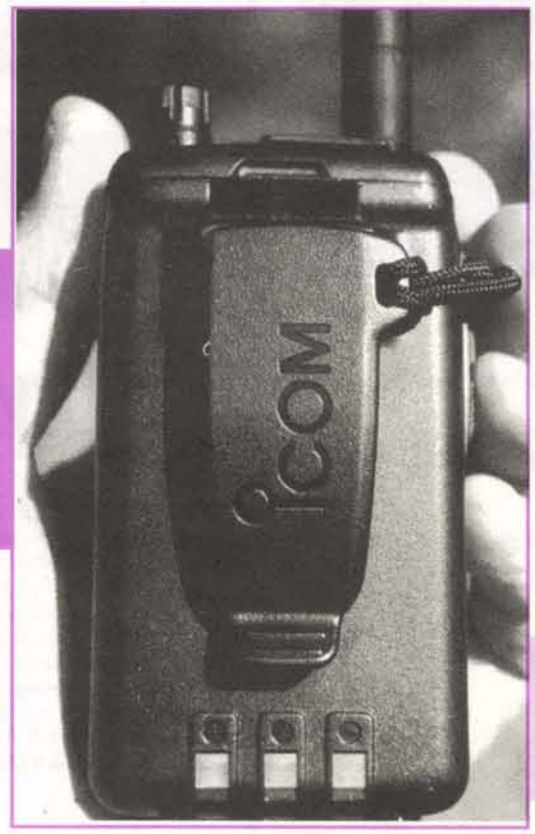
MURS technical types could easily buy a 151 MHz and 154 MHz unit, interconnect a simple carrier or VOX circuit, hook both units up to a pair of ground plane antennas separated by at least 50 feet, and run on these two channels as an automatic repeater station. Well-respected radio activist Corwin Moore of the Personal Radio Steering Group (www.provide.net/~prsg) comments, "This could become a completely unmanageable monster," referring to the new MURS frequencies.

The FCC comments in their report and order, "*... We agree with the commentors that because of the manner in which manufacturers have chosen to market radios that operate on these frequencies and our elimination of the frequency coordination requirements on the low-power frequencies, it would be in the public interest to eliminate the licensing requirements for them.*" In other words, since these frequencies are already overrun with illegal users (green dot and blue dot), go ahead and just give them the band!





MURS radios may be tied into an outside antenna system for extended range (two-watt ERP limit).



What will the MURS radio look like? Here is a peek!

out about amateur radio two-meter amplifiers that easily work at 152 and 154 MHz from their normal 146 MHz tuned position, powerful signals will dominate the different channels, and dedicated MURS users will then resort to directional beam antennas to help cancel the clutter.

In five years, I anticipate the five MURS channels talking not much further than FRS due to channel loading in metropolitan areas. But take your little MURS handhelds out on the secluded lakes, or up in the mountains, and you'll begin to enjoy the 5 to 10 mile range that two-watt MURS equipment was designed to deliver.

And chances are, out in the open and away from a high concentration of MURS users, things will be quite fine.

Some radio experts view MURS as the new VHF Citizens Band and also see it as a much more powerful way to communicate than presently over the little tiny half-watt FRS walkie-talkies. Keep in mind that a MURS radio may feature an antenna jack that could allow users to hook into a well-elevated antenna system to further their line-of-sight range.

Two watts of effective radiated power is more than enough to travel several hundred miles on a line-of-sight basis. If you just happen to live on top of a big mountain, or operate your MURS unit at the top of a skyscraper, you could easily make contact over 100 miles away.

But if you're going to play "DX" (long range in "ham speak") communications, you better hop on the band wagon right now while the channels are relatively clear. Just as soon as the five MURS channels begin to load up with users, none needing call signs or FCC registration, the ultimate range will begin to shrink dramatically due to same-channel interference. And once MURS users find

Radio expert Chuck Gysi writes, "Extended range would be offered as a two-watt repeater and an antenna at the right elevation." Rich Moseson W2VU, of *CQ Magazine* comments, "MURS could have a tremendous impact on amateur radio. Those who like what MURS offers, but are frustrated with its limitations or crowding, will become prime recruits for ham radio."

If you have a scanner, try tuning into the five frequencies now assigned for MURS. Listen to a completely new radio service that may grow into a powerful and valuable short-range VHF Citizens Band service with a purpose. Let's hope MURS may extend the range and endless communication possibilities that FRS was not able to offer. Just the idea of almost any type of emission permitted on MURS gives these five new frequencies some real possibilities. **NV**

MURS radios could be tied into GPS positioning.

ADVERTISER INDEX

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Prepaid ads received by 5:00pm on the **closing date (5th of the month)** will appear in the following month's issue. Ads postmarked through the **5th**, but received after the closing date, will be placed in the next available issue. No can ellations or changes after the 5th. Cancellations and changes must be submitted in writing.

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All classified ads are running copy only. No special positioning, centering, dot leaders, extra space, etc. is allowed. All advertising in *Nuts & Volts* is limited to **electronically related items ONLY**. All ads are subject to approval by the publisher. We reserve the right to reject or edit any ad submitted. We do not take ad copy or changes over the phone. We do not bill for classified ads. Repeat ads or ads run in multiple classifications within the same issue are allowed. Paid subscribers may run ads at the 60¢ rate only through their subscription expiration date. **NO REFUNDS**. Credit only. No credit for typesetting errors will be issued unless you *clearly* print or type your ad copy.

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70. Computer Equipment Wanted	150. Plans/Kits/Schematics
80. Test Equipment	155. Manuals/Schematics Wanted
85. Security	160. Misc. Electronics For Sale
90. Satellite Equipment	170. Misc. Electronics Wanted
95. Military Surplus Electronics	175. BBS & Online Services
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115. Telephone/Fax	200. Repairs/Service

Product/Category INDEX

Find what you need FAST

Amateur Robotics

by Robert Nansel

Last month, y'all may recall we were in a tizzy here at the Robot Ranch. My wife was in hurry-up-and-wait labor, and I didn't know the outcome in time for my February column. Now it's a month+ later, and the suspense is over: We have a new baby boy in the house, Nadav Amiel Nansel, born 13 January 2001. He came into the world at 8 lbs. 15 oz. – 4 Kg for you SI types.

"Nadav" means "generous" in Hebrew (can you tell he's a rabbi's kid?), and both he and Shoshana are doing great.

I picked up Yonatan from our babysitter the day Nadav was born, and I told him all about his new baby brother. Yonatan picked up Nadav's name right away, kept saying "Dav, Dav, Dav!" When I took Yonatan down to the hospital the next morning to meet 'Dav, however, it took all of 20 seconds for him to lose his initial enthusiasm and become, shall we say, cautiously pessimistic.

His mood became downright hostile when we brought Nadav home. He would burst into tears and cry "No baby, no baby!" One afternoon, I found him standing in a corner of his room with his blanket over his head; he was sucking his fingers – and bonking his head against the wall.

I 'spose it's safe to say Yonatan (who just turned two) is skeptical of Nadav, and he reckons Nadav's charms overestimated, especially compared to his own inalienable cuteness. We're a month on, and the tears and tantrums have mostly subsided; the cautious pessimism, though, may be with us for the long haul.

As for Nadav, he eats and sleeps an awful lot, but he tends to want to eat when we want to sleep and doesn't sleep when we want to eat. The result is we know when it's day and we know when it's night, we know when it's time for us to eat and time for Nadav to eat, but without looking at a calendar, we can only guess which day of the week it is. I think today is Monday. I also suspect that it's February because my March column is due.

Anyway ...

Progress on Heavy Iron has slowed some since Nadav came home, because I have less time to work on it, but also because I'm just not getting enough sleep to be trusted with power tools.

Despite all this, I have managed to work on a few simple robotics projects (ones not involving power tools). I've made CAD drawings of the compound slide table I'm using for Heavy Iron's Z-axis, and I've gathered a few odds and ends to help with my crucible furnace project. I've been studying BEAM robotics techniques, so I've been fooling with a few Solar Engine circuits. Finally, I've been doing great gobs of reading in the topic of Artificial Life, so I've got a book recommendation. Let's get going.

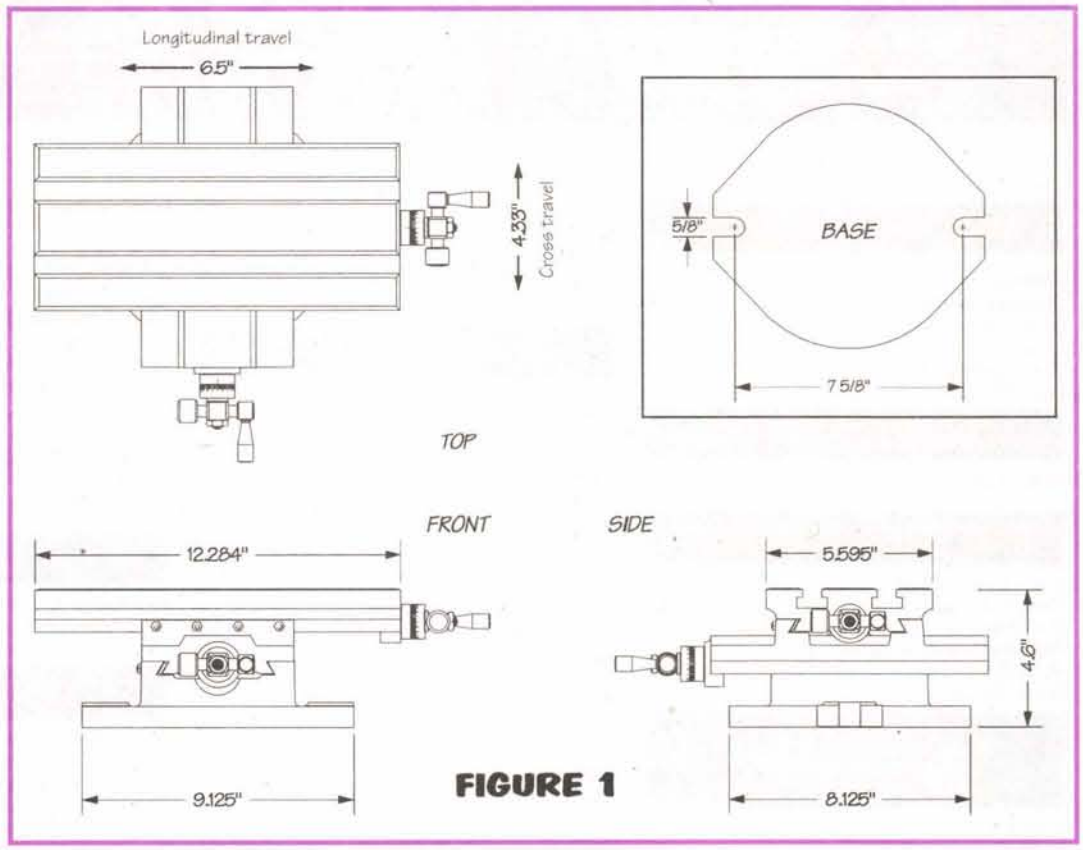

FIGURE 1

PHOTO 1: Enco compound slide table for Z-axis.

Heavy Iron Update

Last month, I gave the basic dimensions of Enco's larger X-Y table (model #201-2536), as well as how it fits into the design of Heavy Iron. It has a roomy 18.5" x 6" T-slotted table and a longitudinal travel of about 11". Enco claims 7.5" cross travel, but that's from stop-to-stop with the saddle running halfway off the base's dovetails at either end of travel.

The fully-supported cross travel is a miserly 2.25", but with proper adjustment of the gib screws, I reckon the table probably has a practical cross slide range of about five inches under medium machining loads. The lighter loads a PCB drill and router will make on the table might let me get perhaps seven inches cross travel out of the table without too much difficulty. Bolted to the massive steel C-section of Heavy Iron's bed, the table will serve as the machine's X- and Y-axes of motion.

That leaves the Z-axis. Back in autumn when I first began thinking about this project, I figured I would get a cheap X-Y cross slide vise to make the Z-axis. I intended to dismantle the unit and discard the vise and one of the slides, but it seemed worthwhile because you can get these dudes for less than $70.00 US from Harbor Freight. I ordered a 6" cross-slide vise (model #32997) from Harbor Freight Tools for the Z-axis.

I was disappointed. The slides and leadscrews turned out to be quite roughly machined compared to the Enco table; the bearing brackets were crude steel stampings and would have to be entirely redone, and to top everything, one of the ACME leadscrews – the one I wanted to use – was bent.

Two X-Y tables?

I might have been happier with Harbor Freight had I ordered one of their smaller units. Some of them have nearly the same travel as the six-incher I got, and they cost quite a bit less so I wouldn't have minded the clean-up machining needed to bring one up to snuff.

My preferred solution now is to use Enco's model #201-2826 Compound Slide Milling and Drilling Table for the Z-axis (Photo 1). It's a bargain at $66.95 US on sale – about what I paid for the vise.

Figure 1 shows the basic dimensions. It's a solid 35 lbs. of cast iron and has a fully supported cross travel of 4.33" and longitudinal travel of 6.5". It features a 12.28" x 6" T-slotted table which will make it easy to mount different spindle options or even temporary spindles to enable Heavy Iron to machine some of its own components.

Unlike the cross slide vise, I won't be stripping one of the slides and discarding the other. I confess that I find the little table to be too nice to consider cutting it up.

Robotics

Though I may drill some holes in it, I'd like to retain the option of using the table as an X-Y table again in the future. For this reason, and because it's simplest, I'll just tighten the gib screws on the redundant axis to lock the lateral slide. As shown in Figure 2, the whole table will be bolted sideways onto the vertical column with the longitudinal slide forming the basis of the Z-axis motion.

If you are determined to go the cheapest route possible, by all means check out my December 2000 column for photos of the Harbor Freight vise. I've sized Heavy Iron's Z-axis mounting brackets to accommodate either the 6" vise or the Enco table.

Another option for those of you wanting a slightly smaller (and cheaper) machine, is to use two of these #201-2826 tables: one for the Z-axis as described above and another one for the X and Y motion instead of the #201-2536. As I've already noted, the #201-2826 has 6.5" x 4.33" travel, enough to comfortably handle circuit boards up to about 6" x 4" in one "bite."

With the smaller table, however, the cross leadscrew travels with the saddle, so this slightly complicates mounting a stepper drive on that axis (not a big deal, just something to be aware of). For using one of these tables as a Z-axis, I have to deal with this issue anyway because the leadscrew of the longitudinal slide moves with the table. For that matter, the longitudinal feed of the #201-2536 table works the same way.

(Harbor Freight Tools can be reached at www.harborfreight.com or 1-800-423-2567; Enco can be reached at www.use-enco.com or 1-800-873-3626.)

Crucible Furnace

Photo 2 shows the components I've gathered and fabricated to date for a charcoal-fired crucible furnace, another of my metal-working projects. This project had been on hold for more than a year, but during last summer's GEAR, Gene Elliott showed us all how easy it really is to melt aluminum using simple equipment (see my September 2000 column for the details).

Construction of the furnace I'm building is described in detail in *The Charcoal Foundry*, Book 1 of the seven-book *Build Your Own Metalworking Shop from Scratch* series by Dave Gingery. If you have any interest in metalworking and you've never heard of these books, I urge you to take a look at the Lindsay Publications catalog (available online at www.lindsaybks.com, or you can write to them at Lindsay Publications, P.O. Box 538, Bradley, IL 60915-0538).

What you need is a five-gallon steel bucket which you line with a refractory – the cheapest being a mixture of plain fireclay and silica sand. I've had the sand and clay for a couple years, but in December, I finally made time to cut up some pieces of galvanized sheet metal and disks of plywood to serve as forms for the refractory lining. The plywood disks are the end caps, and the wide strip of sheet metal in the photo will wrap around the disks to make a temporary cylindrical form to be placed in the bucket. I'll tamp down the fireclay mixture between the walls of the form and the bucket to make a lining about two inches thick.

After the walls of the lining have cured, I'll collapse the temporary form and strip it out (that's why one of the plywood disks has grab holes cut into it). Then I tamp in a layer of fireclay on the bottom.

PHOTO 2: Parts for charcoal crucible furnace.

The narrow strips of sheet metal in the photo will be used to edge a refractory lid. This will be a simple disk of cured fireclay, the same diameter as the top of the bucket with a vent hole in the middle and a couple eye bolts to help with lifting the lid when it's hot. The refractory disk will be reinforced by steel wire woven through holes drilled in the sheet metal edge band.

I still need to collect a couple more items to make the furnace. First, I need a couple lengths of 1.25" metal tube to make the tuyere form. The tuyere (pronounced "tweer") is a hole near the bottom of the furnace where you connect an air blower to make the fire burn hotter. The second item is the air blower itself. The nice thing about this charcoal furnace design is that a simple hair dryer provides plenty of airflow to

If you have suggestions, questions, or comments about amateur robotics topics, you can now reach me at:

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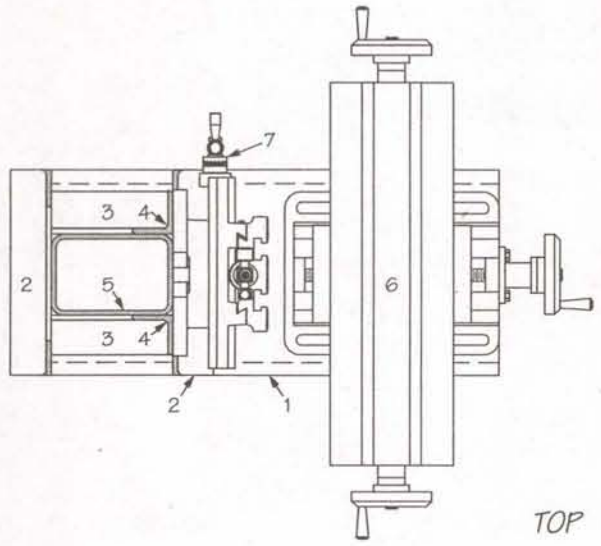
Box 228
Ambridge, PA 15003

Email:
bnansel@nauticom.net



1 Machine bed, 1 ea, hot-rolled steel channel, 10" x 3" x .5" x 24"L (26 lb/ft)

2 Column bracket, 2 ea, hot-rolled steel angle, 2" x 2" x 1/4"T x 10"L

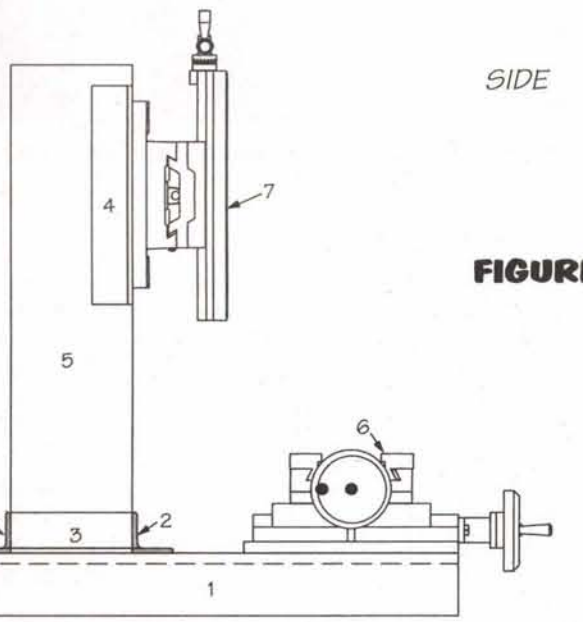
3 Column bracket, 2 ea, hot-rolled steel angle, 2" x 2" x 1/4"T x 6"L

4 Z-axis bracket, 2 ea, hot-rolled steel angle, 2" x 2" x 1/4"T x 10.75"L

5 Column, 1 ea, hot-rolled rect. steel tube, 6" x 4" x 1/4"T x 24"L

6 Enco Heavy-Duty Mill & Drill Table, Model 201-2536

7 Enco Compound Slide Milling & Drilling Table, Model 201-2826



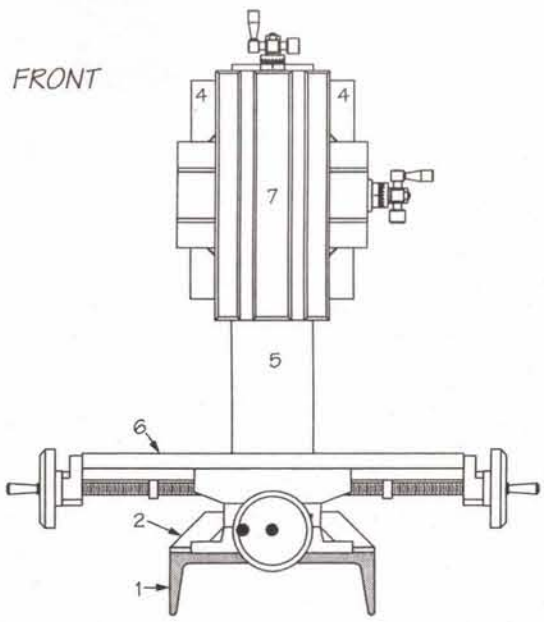


FIGURE 2

melt aluminum, a real plus in a neighborhood like mine where folks tend to look down on running a blast furnace in the back yard. If you want to melt brass, you need a higher airflow source (a vacuum cleaner will do).

Once I get the furnace built, there's still lots of pesky details like obtaining molding sand, building cope and drag flasks, and making patterns, so at my current rate of progress, it will be sometime late spring before my first melt. Stay tuned.

Solar Engines

As I mentioned last month, I'm assessing the potential of BEAM robotic techniques for the Tall Grass project, my proposed all-weather backyard robots. Since the Tall Grass series of robots aims eventually to reach 10,000-hour endurance levels, two considerations dominate the design: 1) Solar power is the only feasible power source for these free-roving robots; 2) The robots' systems must be extremely reliable. As a corollary, even as reliability must be maximized, cost must be minimized (I've got two college educations to save for now). This means I can't avail myself of the NASA method for increasing a system's reliability, (to wit, throwing money at the problem), so I must use the KISS method instead and make my robots reliable by drastically reducing their complexity.

The BEAM school of robotic design, after its fashion, has these bases covered. Though I take issue with a few of the more extravagant claims made by some BEAM adherents (in particular, regarding what it means for a system to "converge" on a solution), there's an awful lot of good work being done out there on solar-powered robots.

Relaxation is Key

This month, I tried out two of the dozens of so-called "Solar Engine" circuits available. A Solar Engine ("SE") is a circuit that allows a relatively low-current photovoltaic solar panel to drive a load that nominally consumes a much greater current than the panel can supply. Obviously, this means collecting low-current solar energy over time, then releasing that energy occasionally in the form of high-current bursts sufficient to drive the high-current load (typically a motor). When and under what conditions the stored energy is released are the main parameters that vary between different SE designs.

The simplest way to do this for low-power systems involves a relaxation oscillator where the solar panel charges a high-value capacitor until a predetermined voltage trigger point, then dumps all the stored charge at once through the load. Figures 3 and 4 show the circuits I built based on schematics available on the web (www.beam-online.com/Robots/Circuits/circuits.html). I used the same solar panel, capacitor, and motor for both circuits so I could get some idea of relative performance of these two very simple circuits.

Though I specify a Panasonic solar panel module, most any module that produces three or more volts will work, including the tiny solar panels used in solar-powered calculators. That's one of the charms of this approach to robotics: many of the components – both mechanical and electronic – that you need to build robots can be readily salvaged from discarded calculators, Walkmans, pagers, and the like. This means you can try BEAM-style robotics, and if you don't like it, then you haven't necessarily spent a lot of money.

FLED SE, See?

The first circuit (Figure 3) is the classic FLED SE. This circuit is older and a little less efficient than newer variants, but it has the advantage that the parts are cheap and available worldwide. The voltage trigger in this circuit is the "FLED," a simple flashing LED, the type with its own LED flasher chip built right into the LED case.

When you first build the circuit (note the absence of a power switch), the capacitor C has zero volts across it, and thus no energy stored. Solar panel PV begins charging the capacitor at a rate determined by its short circuit current. PNP transistor Q1 is biased off because its base is pulled toward V+ through the series network formed by resistor R1 and the rotor windings of motor M; NPN transistor Q2 is also biased off because its base is starved for current since Q1 isn't conducting.

But for the FLED, once the capacitor is charged to the maximum voltage of PV, the circuit would stay in this state forever, consuming a minute amount of leakage current through Q1 and Q2. The circuit doesn't stay stuck, though, because the FLED operates as a low-current voltage trigger. The FLED conducts very little current until the voltage across it rises above about 2.5V, the minimum operating voltage of the FLED. The FLED turns on, briefly bringing Q1's base low and thus turning Q1 on. Q1 now supplies current to Q2's base; Q2 saturates, allowing discharge current from capacitor C (plus the much smaller current of the solar battery) to flow through the motor windings. The low Vce saturation voltage at the collector of Q2 forces Q1 to stay on even after the FLED turns off, thus forcing Q2 to stay on, as well. In essence, Q1 and Q2 form an SCR latch which, once triggered, continues conducting until most of the charge in C is gone. When the voltage drops below about 0.7V, the transistors turn off and the cycle starts over.

Gotchas

The FLED SE has a couple characteristics to keep in mind. First, the

circuit is at its best in bright light. The ceiling fluorescent lights in my office, for instance, take about 15 minutes to fire the motor (if it ever fires at all). On my windowsill in indirect sunlight, however, the circuit pulses the motor about seven or eight times a minute and, in direct sunlight, it pulses every few seconds.

Second, like any LED, a FLED is not just a light emitter, it's also a light detector. Certain light levels are reputed to make a FLED circuit misbehave, and for this reason, FLED SE builders often cover their FLEDs with an opaque material such as heat-shrink tubing or paint to prevent erratic operation.

In my own experiments, I wasn't able to confirm any change in circuit operation when the FLED was covered or not. This may be more of an issue with solar batteries that produce lower current or voltage than the model I used. I want to investigate this further because it seems to me the effect – if it can be tamed – might be useful for building light sensitivity into systems incorporating FLED SEs. Indeed, Ben Hitchcock's "FRED" variant of the FLED SE puts the effect to good use (http://wollongong.apana.org.au/~ben/fred/schematic.html).

1381 SE

BEAM builders thrive on putting components designed for other purposes to new uses in their designs. One such component is the MN1381 voltage detector chip. This three-pin chip was originally designed to monitor the power supply voltage for microcontroller circuits. Micro-controllers must have a steady voltage supply at a specified minimum voltage for proper operation, and this is impossible to guarantee when power is first turned on. The solution is to monitor the relatively slowly rising supply voltage and hold the MPU chip's reset line low until the supply voltage reaches a safe level. Since MPU systems often operate from batteries, the reset control circuit must have very low power consumption.

The Panasonic MN1380 series of voltage detector chips is available in several voltage trigger levels, ranging from 2.2 to 4.9 volts. The MN1381J, for instance, pulls its CMOS output (pin 3) low until the input (pin 2) reaches about 2.9 volts, whereupon pin 2 goes high. The chip has 300 mV hysteresis built in to prevent false triggering near the threshold, so the voltage at the input must drop back down below 2.6V for the 1381 to again pull pin 2 low. This makes the MN1381J a perfect voltage trigger for a solar engine that produces at least 3V.

All you have to do to convert the FLED SE is remove the FLED from the circuit in Figure 3 and replace it with an MN1381J as shown in Figure 4. When the capacitor reaches 2.9 volts, the output pin of the 1381 goes high, thus turning on NPN transistor Q2 which, in turn, forces PNP transistor Q1 to turn on, etc. Unlike the FLED SE, in this circuit, it's the NPN transistor that gets turned on first, but the result is the same.

The circuit is a little more efficient than the FLED SE. My prototype produces about 9 or 10 motor pulses a minute in indirect light, and a motor pulse every other second in direct sunlight.

I'm not sure how I might use these sorts of circuits in a Tall Grass robot. Tall Grass robots will store most of their energy reserve in batteries rather than capacitors, but they'll use large capacitors to reduce the peak current pulses the batteries must supply. This will increase battery life (because fewer high-current charge/discharge cycles would be needed), and reduces the size of the battery needed. Whether they would also use the relaxation oscillator technique to dole out power bursts is another question. More in future columns.

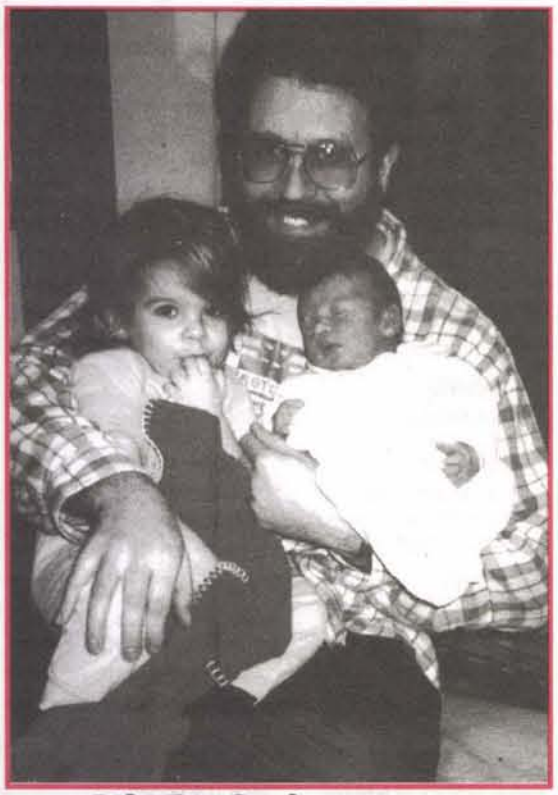
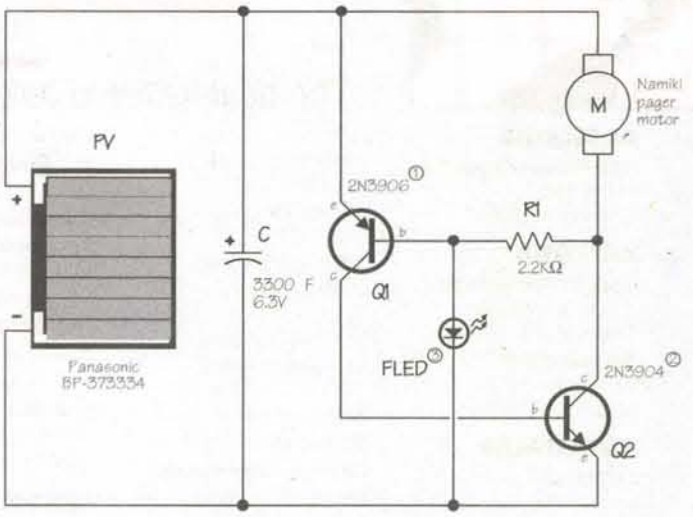


PHOTO 3: Yonatan and Nadav and me. (I'm the one with the glasses.)

FIGURE 3
FLED SE



Notes:

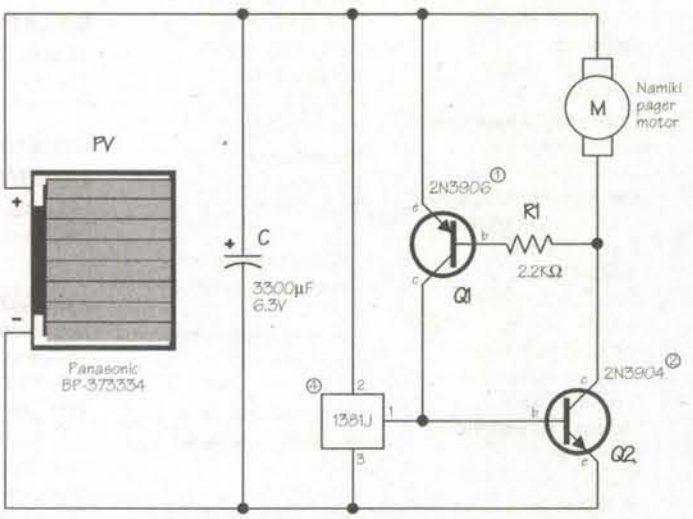
① May substitute BC556A

② May substitute BC546A

③ Flashing Green LED, Radio Shack # 270-030 or similar

④ Panasonic MN1381J has a 2.7V trigger voltage. Other trigger voltages are available, ranging from 2.1V to 4.7V

FIGURE 4
1381 SE



Artificial Life

Given my current interest in free-range robots, it seemed natural to read up on Artificial Life. There is no better introduction to this topic than Steven Levy's book *Artificial Life: A Report From The Frontier Where Computers Meet Biology* (1st Vintage Books ed. 1993, ISBN 0-679-74389-8).

I had resisted reading Levy's book when it came out in the early 90s for reasons that seemed good at the time. I admit it, I held the prejudice that Artificial Life (A-life) was just about simulations and pretty pictures, that it had little to offer folks who build real robots to operate in the real world. Boy, was I wrong.

It's true, part of A-life is about virtual worlds and flashy graphics, but the intellectual wellsprings of A-life are as deep and profound as anything Artificial Intelligence has to offer. A-life concepts provide common roots for areas as diverse as cellular automata, genetic algorithms, neural networks, and subsumption archicture robotics. In fact, A-life seems more likely to me today to produce the insights we need to build robots that are at home in the real world than classical AI approaches.

A-life includes in its core the notion that complex behavior is often an emergent property of systems operating with a few relatively simple rules – that the observed complex behavior of life and, increasingly, of machines needn't be pre-programmed.

This is good news for me as a robot builder, because software has always been my Achilles heel. Read *Artificial Life*. This is not just another science popularization, but a well-crafted history and explication of the ideas of A-Life. It's a fascinating read, and my only regret is I didn't read the book eight years sooner. **NV**

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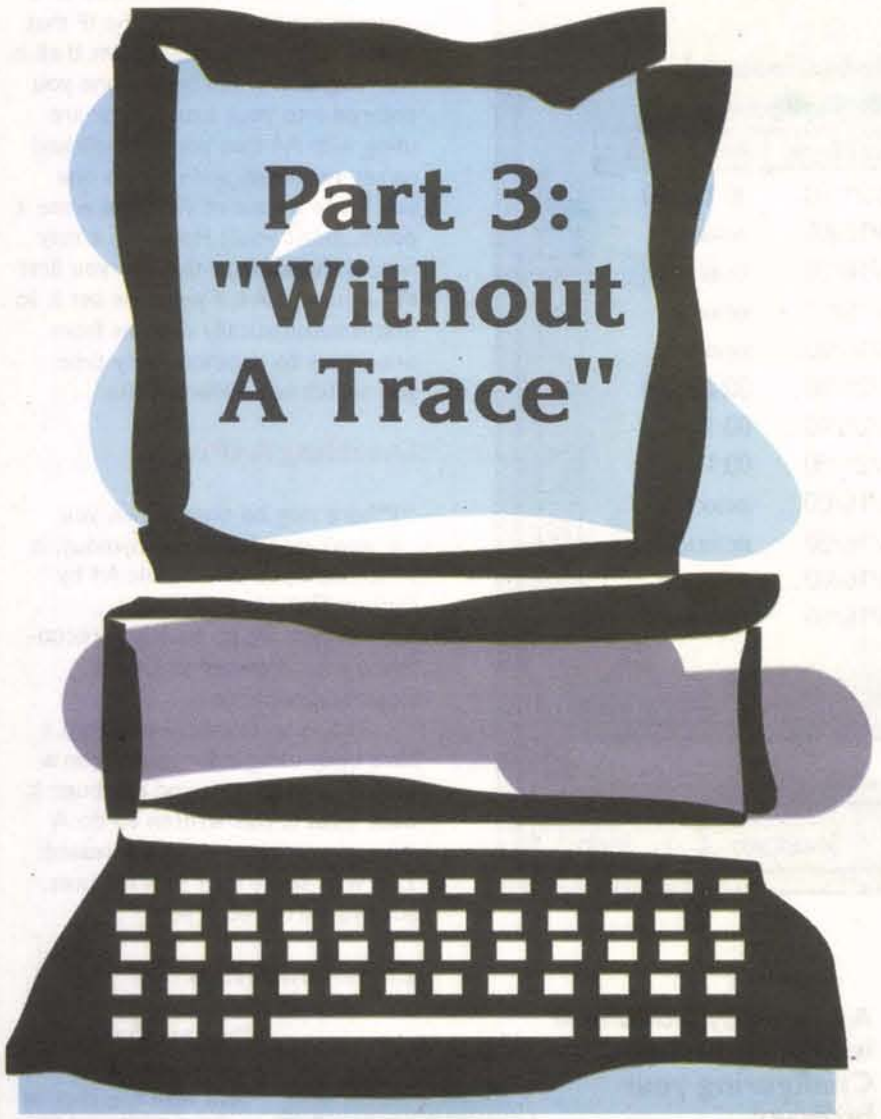
Cyber-Street Survival

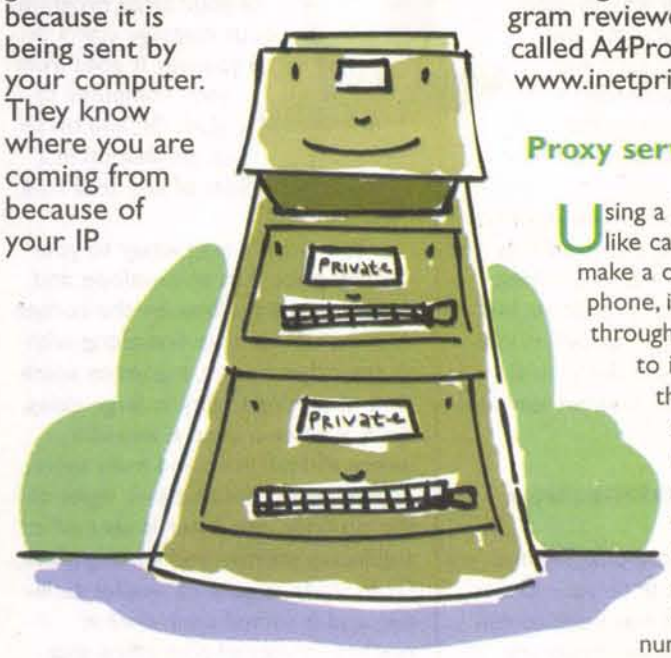
by M L Shannon



Welcome back to Cyber-Street. In this, the third article in the series, we will have a close look at Email, about making it more private, and some more on spam. But first, let's get right into things you can do.

Remember from the first article what you read about log files? How, when you connect to any web site, you leave information about yourself that is stored in these files? These sites are able to get this information because it is being sent by your computer. They know where you are coming from because of your IP address. They may also know what sites you visited previously. You have also read a little about Cookies and banner ads and what they can do.

By using a Proxy you can avoid these problems. Reveal less information about your browsing habits. The program reviewed here is called A4Proxy, available at www.inetprivacy.com.



Proxy servers

Using a Proxy is sort of like call forwarding; you make a call from your phone, it is relayed through a second phone to its destination. At the other end, if someone was using Caller ID, they would see the number of the second phone and have no way of knowing the number of the first phone; the one you actually used to make the call. When you surf the World Wide Web through a Proxy, you hide your IP address just as call forwarding hides your telephone number. A Proxy, then, is a computer that you connect to using your web browser that 'forwards' you to the sites you visit using their IP and not yours. And, they are legal to use. At least for now ...

To use a Proxy, obviously you have to have one. There are hundreds, located all over the world; many of them are in Sweden and The Netherlands. Some are at large corporations, some at small businesses and universities. A comprehensive list is at http://poisk.hypermart.net/proxy.htm. You can go there and select one to use. For now, choose one that is listed by its IP (numeric) address. For example, 204.120.251.236:80. In a future article, we will go over some Internet tools one of which converts IP addresses to their 'Plain English' site name.

If you haven't already, please go to Gibson Research at www.grc.com and download a free program called IP Agent. Install it the same as you would any other program, and you will see an icon which is a red circle with the letters 'IP' on your desktop. While still connected to the Internet, double-click it and it will display the IP address you are presently using. Presently. Remember that with a modem dial-up account you probably have a dynamic IP which changes each time you connect. Make a note of it.

Next, configure your browser. If you are using Netscape, click on Edit, then Preferences, Advanced, and Proxy. A dialog box will open where you can type in the IP you will be using. Note the '80' goes in the right-hand column without the colon. If you are using the Opera browser, click File, Preferences, Connections, and a dialog box pops open where you can enter the IP much the same as with Netscape.

A4Proxy

A better way is to have a program that does most of the work for you. That's because Proxy Servers come and go, some are very slow compared to others, some are anonymous, meaning that they do not forward your own IP address to the log file at the site you are visiting, and others are not anonymous. There are dozens of these programs that you can find at www.winfiles.com but most of them, all but a few, are intended for use with networks. They make it possible for all of the computers in a small office or network to share the same Internet connection. They are not designed for use on a single computer.

The A4Proxy program works on a single computer. And it includes a list, updated periodically, of several hundred Proxies you can connect to; relay through. It has many useful features such as checking all the Proxies on the list to see which ones are up and running, and how fast they are. You can set it to use the same Proxy until you change it, or to automatically switch to another one every time you connect to a different web site. Now, that's anonymity.

Setting up A4

Download the program from www.inetprivacy.com to a subdirectory of your choice. Once complete, close any Windows programs that are running and, if using a modem dial-up ISP disconnect from the Internet. From Desktop, do File and Run. Installation takes only a minute, after which you will see the screen shown in Figure 1.

In the center is the list of proxy servers included with the program. The trial version has about 25, the

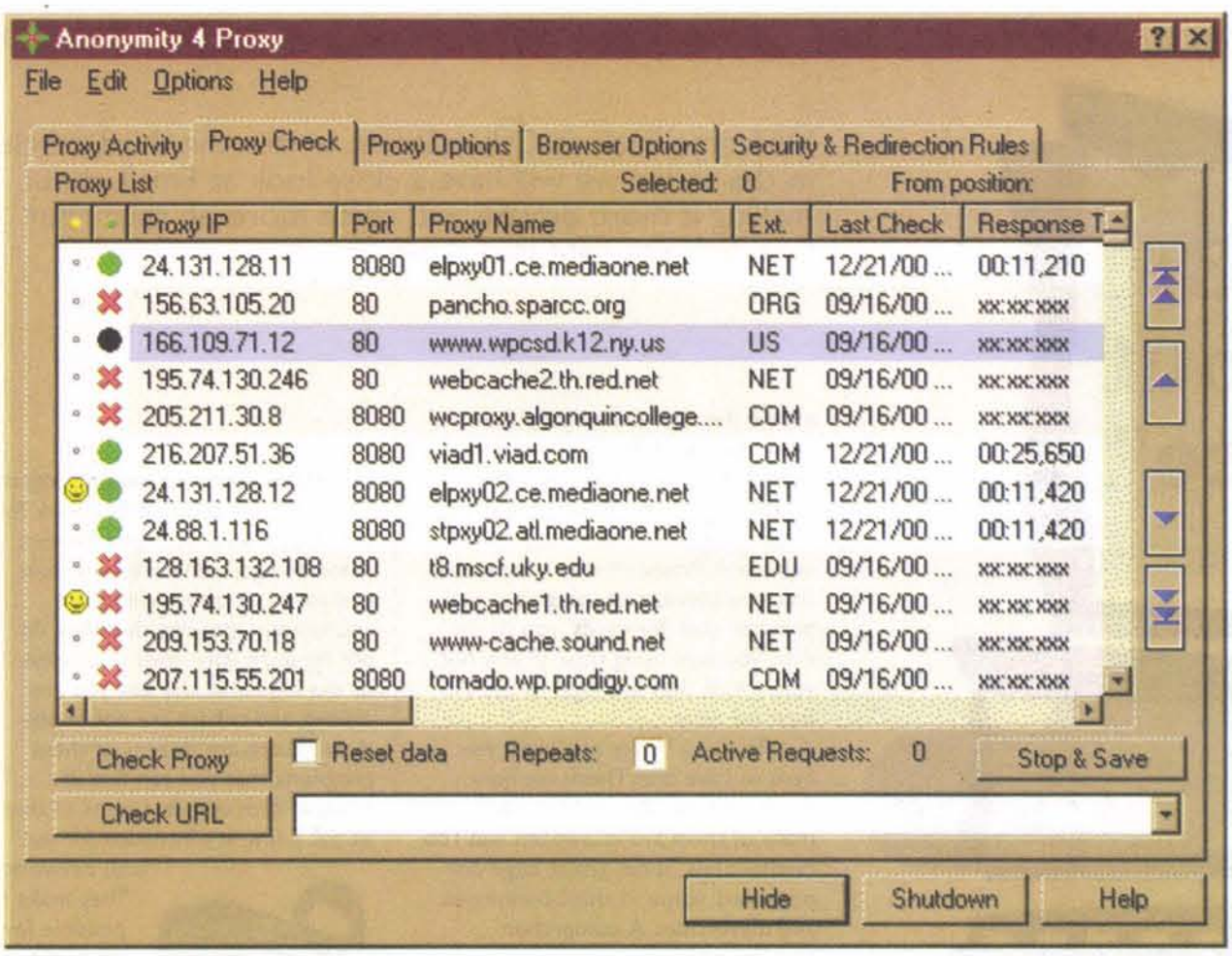


FIGURE 1

registered version several hundred.

Now, log back on. If you are using the Zone Alarm or any other Firewall, turn it off for now. A4 will not work if a firewall is in use. Click one of the listings near the top of the screen to highlight it. Then click the Check Proxy button. (With the registered version, you can check them all at once and this may take a while, so you can stop it with the Stop & Save button.) You will see the icons on the left changing as A4 checks the servers to see if they are up and running.

The icons that are green are working and anonymous, those with the red X are not. Click on a green one, then right click and select Set As Default. Also click Add To Favorites and the yellow smiley face appears. Finally, click Options and make sure Direct Connect is not checked.

A4 is ready, but there is one more step: Configuring your browser

This is done the same as in the above example except that you enter 127.0.0.1 as the proxy. On the right, enter the port number as shown on the screen. Use 80 for the WWW, and the same for SHTML but for now, it is not necessary to use the others. The Help files have step-by-step instructions for Netscape and Internet Explorer should you need them. If you are using Opera, the procedure is the same as with Netscape; use 127.0.0.1.

A4Proxy has other settings that you can experiment with, and they are explained very well in the Help file. It is not necessary to do so, but if you like, have at it. Meanwhile, you are now able to roam the Web to your heart's content without leaving a trail behind you.

Testing your connection

Whether you are plugging in a single Proxy IP to your browser, or using A4, you may want to run a test to make sure you really are being 'forwarded.' Now, at GRC, go back and redo what you did in Part 1. Click on Test My Shields and an IP address will be displayed; the IP that Gibson sees you coming from. If all is working, this IP will be the one you entered into your browser, or are using with A4 that you right-clicked to set as default, and not the one you made a note of. (You did write it down, didn't you?) However, it may not be the same as the one you first used through A4, if you have set it so that it automatically changes from one proxy to another every time you switch to a different site.

Disabling A4Proxy

There may be times when you don't want to be anonymous, in which case you can disable A4 by clicking Options and Direct Connection. Or, go back and reconfigure your browser to Direct Internet Connection.

This is an excellent program. I have been using it for more than a year and have not found any bugs; it does what it was written to do. A new version was recently released; 2.51 with some neat new features, but I haven't tried it yet.

Electronic mail

Fascinating that you can type a letter and with the click of a few keys, send it to someone thousands of miles away, and it is delivered in a few seconds. When you hit the <SEND> button of your Email program, your message starts on a journey. It goes from your computer to your ISP and on to its destination in a series of hops. Sort of like Snail mail. I will explain.

You write a long letter to your Granny, place it in an envelope, and drop it in the mailbox on the corner. A carrier picks it up, and along with all the other letters, it goes to some kind of sorting facility. In large cities, there is often a central location where all mail goes, and from there, depending on the first two digits of the zip code, the letter is sent off to a different storage and sorting place. From there, it goes to smaller facilities, and is sorted again until it reaches the actual post office that

delivers to the final destination. All based upon the zip code.

Packets

Everything that gets sent over the Internet, whether it is Email or a program or graphic being downloaded, everything goes in small pieces called packets. It is like you sent your Granny's letter one page at a time; each page in a different envelope.

Every packet contains a header which has (among other things) the destination address so that it can get where it is supposed to go. The destination address is read by one or more routers along the way. These routers analyze the header, consult a series of tables, and decide if the final destination is where that router is, or if it is to be forwarded to another router that is closer.

Eventually, the packets get to a router that, after it consults its tables, says to itself, "Hey, this IP belongs to me. This packet goes here. I don't need to forward it to another router." A slight oversimplification, but that's basically how it works.

Hippety hippety hop

Each one of these 'forwards' is called a 'hop.' In its path, the packet might have more than a dozen hops. Now the shortest distance between two points may be a straight line, but this does not apply to Internet routing. You are in Nevada, and your Granny is in Iowa. But the message might first go to Virginia. Sort of like United Airlines. If you want to fly from Cleveland, OH to San Francisco, you have to go by way of Atlanta, GA. Go figure ...

In Part 5, we will review a program, Net Demon, a suite of Internet tools one of which is Traceroute. This tool will list most all of these hops and explain what and where they are. No reason to wait, though. Get Net Demon at www.netdemon.net. Another Traceroute program, Visual Route, has an online demonstration at http://visualroute.zitel.com/. Just type in an IP address and watch. Pretty nifty, eh?

It is a good idea to set your Email program preferences so that all messages are downloaded when you read them. In other words, they are not left stored on your ISP where they could possibly be accessed. Also, if you get a lot of mail, it will keep the technicians at your ISP from sending you nasty reminders about using up disk space.

Is it really private, my Email?

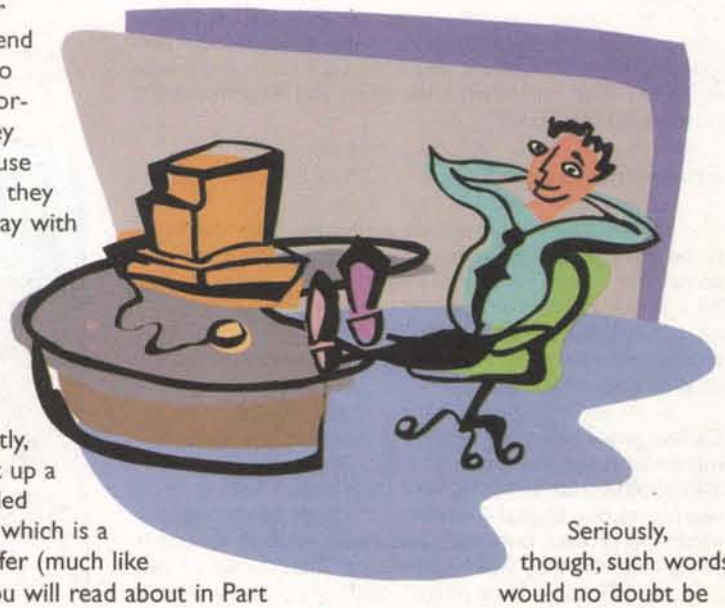
Hop refers to the actual forwarding of the packets from one physical location to another. Each of these locations are called 'nodes.' At any of these points — nodes — there are service technicians who could read what you have sent. Now this would be most unusual, for two reasons. First of all, they may be processing tens or hundreds of thousands of messages and simply don't have the time. And even if they did, what do you have to say that would be of interest to a total stranger? So, for the most part, yes, your Email is private. However, there are exceptions.

Interception

It is possible that people can hack their way into your server, or any of the computers at the nodes along the path, and intercept Email messages. But this is big-time stuff and easier said than done. It requires sophisticated tools, a working knowledge of the UNIX operating system and, of course, there is the matter of getting access to the server. Finally, the farther away, in hops not miles, the server is from the person trying to break in, the more difficult it will be because of the increase in traffic through the server. We will touch on this, without getting into great detail, in Part 5: Hackers and Hacking.

Carnivore

Big Brother is still watching. It is hardly a secret that government agents want to know everything they can about us citizens. And it is not unusual for them to bend the rules to get the information they want because they know they can get away with it.



Recently, the FBI set up a system called Carnivore which is a packet sniffer (much like the one you will read about in Part 4, but on a much larger scale) that can scan Email looking for certain names and key words. If these key words are found, the message is flagged and may be investigated. They are probably copied to a special file and automatically forwarded to some federal spy facility.

The Feds assure us that they use this only if they have a warrant. But whether that warrant is specific to a particular person, which was once required by law, or is a 'blanket' so they can read anything, any mail that contains these key words, I don't know. And they aren't telling.

Okay, your Granny in Iowa (with whom you are now on good terms) sends you Email, telling about a 'great flick she caught.' Granny is cool! So, you send her the following: "... Oh, Gramma, I saw that movie you recommended, but it was a bomb. Now I have some time to kill until the President will be appearing on TV ..." Carnivore intercepts it and 10 minutes later the Secret Service kicks your door down and takes you away and no one ever hears from you again. And you thought only the CIA could make people disappear :).

Seriously, though, such words would no doubt be flagged and while the SS will realize this is a completely innocent message, still the idea of being 'flagged' doesn't sit well with some folks. Right now, the FBI is under heavy fire from privacy organizations and many of us Netizens. For the latest on Carnivore, see www.epic.org the Electronic Privacy Information Center.

What you can do

There are umpteen thousand ISPs in this country and it isn't likely

Skinning the Cyber-Cat

It seems there is no limit to what some people will do to get your personal information through the Internet. Or how many demographic dollars they will spend.

A Texas company, Digital Convergence, at www.digital-convergence.com, has been giving away a bar code 'zebra-stripe' scanner, called Cue-Cat, to unsuspecting people. What these little gizmos do is, you use them to scan the code on a package, English muffins or toilet paper or whatever, and you are instantly connected to the manufacturer's sites.

What you are not told when you register this little peripheral is that it is spying on you. When you register, you have to include certain information, including your name, address, age, sex, Email address, and all important zip code. Then, every time you use the scanner, you are sending this personal registration info, and a unique serial number along with the URL of the sites you scanned into, to the manufacturer, DC. That tells them a lot about you. And they build massive databases.

Enter the Hackers

Now hackers are not only inquisitive, they also tend to be a tad skeptical. Especially when someone gives something — a computer-related device — away for free. So, a bunch of people took their little felines apart and discovered that they could delete the serial number by clipping one pin of an IC, or better yet, reset it to whatever they chose. Like zero.

Now, according to an article I read, Digital Convergence had (past tense?) planned to give away 40 million of these gizmos. And at $10.00 per, that's $400,000,000.00. That may well have been a fatal error. As word gets out, Digital Convergence might be forced to scrap the project. But more likely, what with all that cash being involved, they will first redesign the scanner to make it more difficult to hack (rotsa ruck!) and then their attorneys will start lobbying for laws against taking the thing apart. People telling you what you can and cannot do with something that belongs to you.

Someone has already written software so that kitty can run on Linux and Mac, so DC will also probably try to outlaw it just as was done with the Linux DVD player software. See www.2600.com for details.

But whatever happens, thanks (once again) to hackers, the Internet world is learning the truth about Digital Convergence and their fact-filching feline. Hey, DC: The cat's out of the proverbial bag!

Think about it. Digital Convergence was willing to invest $400,000,000.00, believing that they would be able to sell the info they amassed at a big profit. Probably several billion. Again, that may well have been a fatal error. Time will tell. But, isn't it kind of freaky knowing that there are marketing companies that would pay that much money just to learn your shopping habits? It gives you an idea of how big this consumer detail information industry really is.

But you don't have to be part of it. If you decide to get one of these free scanners, you can modify it. Far as I know, there is no law prohibiting this. And, you can use fake registration information. (Think Proxy!) since in doing so, you probably aren't defrauding anyone. Might not be a bad idea, though, to check in at http://cexx.org/cuecat.htm to see what's new on the legal issues.

that the government can install Carnivore on all of them. They might concentrate on the larger servers. AOL, Earthlink, etc., so using a small independent server might avoid Carnivore. Maybe. On the other hand, the Feds might set up Carnivore up at the major hubs, switching centers, such as Mae East and Mae West.

Given the way the Internet is exploding, I suspect it will be difficult for the Feds to scan all of us, but again, most of us don't much like the idea. So, there are a few things you can do.

Sending Email anonymously

There are anonymous remailers and there are free email accounts, but one is not necessarily the other. Rather than have me explain it, this is a little exercise you can do yourself.

Do a search using Dog Pile, www.dogpile.com, for 'free email' sites. There are more of them than you can shake a joystick at, so select a few and sign up.

Once you have the account open, send mail to yourself at your real address. It should get there in a few seconds. Open it and look at the header.

An Email Header contains a lot of information that is usually 'hidden' since you don't need it to send and receive mail. With Eudora, click on the little button that says blah ... blah ... blah. Other Email programs will have instructions in the Help files.

Scan through the header. What you are searching for is anything that can be used to trace email back to you. Do you see your own ISP name? Your real IP address? Your name? The name you gave your computer when you installed Windows?

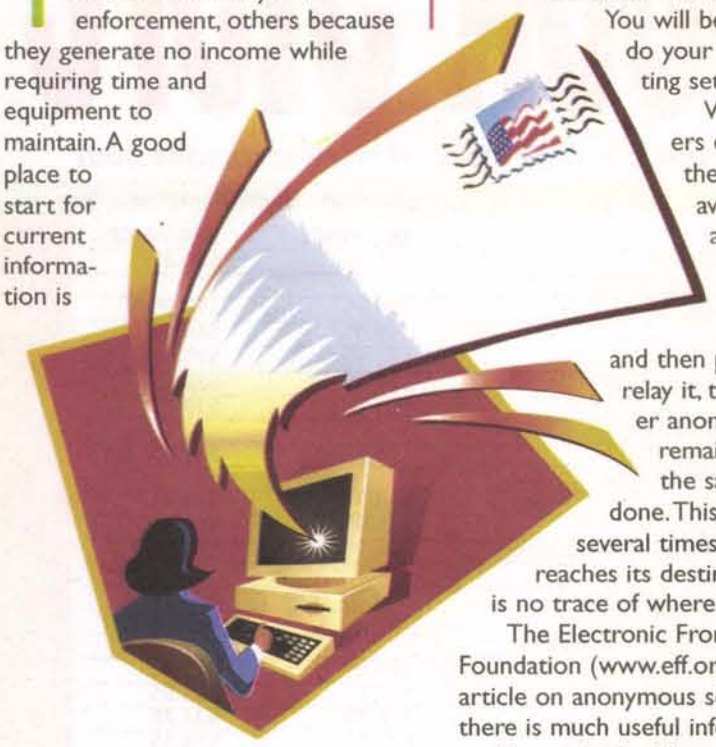
If so, scrap it and find another. Now, do the same thing using A4Proxy, and your IP will not be found in the header.

To help eliminate spam, I have set up a temporary Email account which I use to contact sites that may result in spam. Such as when listing the new site I have built for a client; to get them in the search engines. One of them, Lycos, has been sending several copies of a boring newsletter to me for years and nothing I have been able to do will get them to stop.

So, after a while you can dump the account and open another new one, keeping your real permanent Email free for important things like checking Round Table for specials on pizza.

Anonymous remailers

They come and they go, some are shut down by law enforcement, others because they generate no income while requiring time and equipment to maintain. A good place to start for current information is http://www.cs.berkeley.edu/~raph/remailer-list.html located at the University of California at Berkeley.



You will need to send Email to them to get set up, and they will provide a certain amount of assistance but not hand-holding. You will be expected to do your part in getting set up.

What remailers do is analyze the header, strip away the address where the message originated, and then pass it on, relay it, to yet another anonymous remailer where the same thing is done. This may happen several times, so when it reaches its destination, there is no trace of where it originated.

The Electronic Frontier Foundation (www.eff.org) has a good article on anonymous servers and there is much useful information on Usenet in the Newsgroup alt.privacy.anon-server. Another good web site is http://generalprotectionfault.net/orange/.

Encryption

Scrambling your Email may not disguise its origin or destination but it can make it difficult and even impossible to read. There are many programs, quite a few of which are free, that will do the job nicely, and which will be covered in detail in Part 5. But for absolute security, use Pretty Good Privacy (PGP), a Public-Private Key system which has become the Internet standard. Use it correctly and no one, not even the NSA will be able to defeat it. No one.

For now, you can get PGP (which is free) at http://web.mit.edu/network/pgp.html. Getting it installed and configured is a little tricky, but help is available at www.freedomfighter.net.

As to other programs, you take your chances. They might be very secure, they might not be.

Incidentally, if you are interested in the details of how the Public-Private RSA algorithm works, it is explained in a surveillance FAQ at www.fusionsites.com under the Lysias Press button. **NV**

Next Month:

In Part 4, we will start with another useful program, CommView, for those who want to learn more about what information is entering and leaving their computers. This is a Packet Sniffer, similar to the ones the Feds use in Carnivore. The trial version displays only every other packet, but you will be able to use and understand it from this and decide if you want to register it. The cost is $49.00 for the personal version. An excellent program; I use it and have had zero problems.

Also, we will review your visit to the Gibson Research site, then on to Cyber-Stalking. How it may be possible for certain people to learn enough about you to assume your identity and do things that could make your life very unpleasant. And, of course, more about programs that encrypt your Email, how secure they are, and why using them may or may not be a good idea.

Finally, a look at Internet pornography in an interesting story called "Time Magazine and The Great Cyberporn Hoax of 1995."

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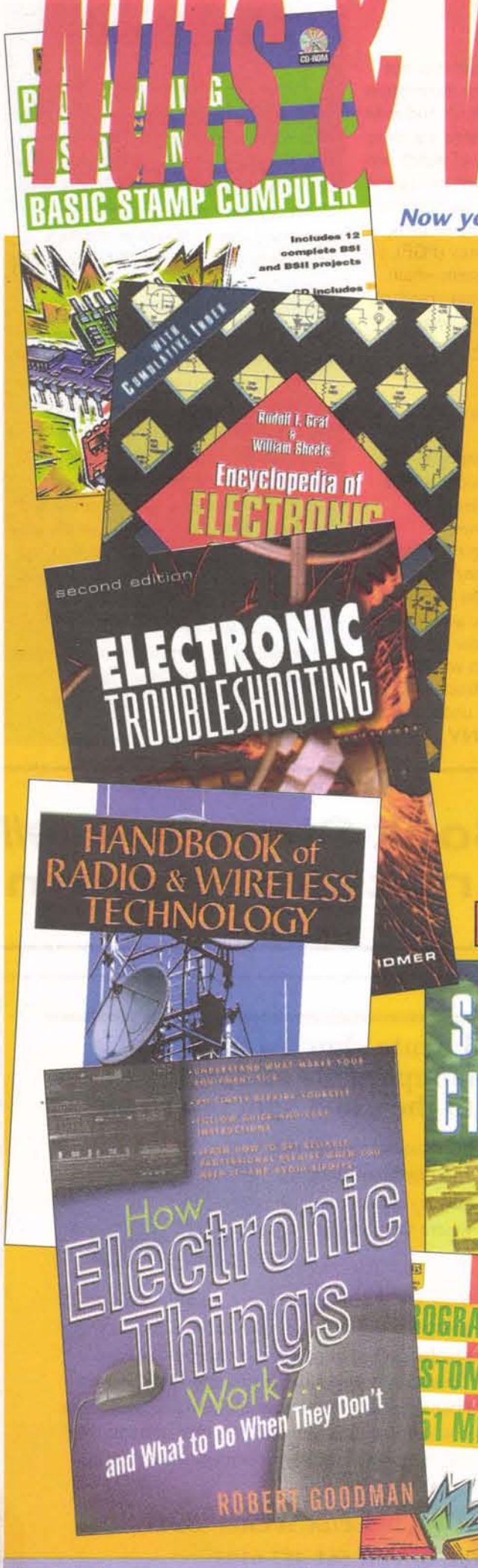

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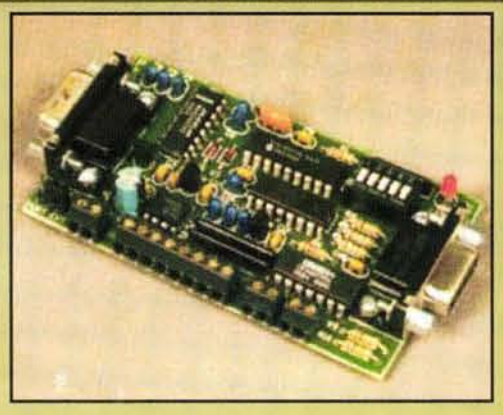
New Product News

ANALOG OUTPUT MODULE



The WTDAC-M is a member of the new stackable RS-232 data modules available from Weeder Technologies.

Four analog output channels span -10 to +10 VDC using a 12-bit DAC. Set distinct DC voltage levels on an output using simple ASCII character strings containing the desired voltage listed in standard engineering units, no conversion necessary.

Automatic generation of trapezoidal and S-curve ramp functions simplify complex multi-point cyclic operations. Individual power-up voltages for each channel can be programmed by the user. Calibration is performed in software eliminating the need for user adjustable trim-pots. Gain and offset coefficients stored in non-volatile memory.

All modules in this series can be plugged end-to-end on a common RS-232 cable attached to the serial port of a host PC. An on-board 32-position DIP switch sets the address of each module, which is used for identifying data transmitted from it, as well as directing data transmitted by the host.

The data bus supports full anti-collision discipline between connected modules and will allow up to 32 modules to share the same communications line. Power is supplied by an external 15 to 25 VDC source (not included) to the first module in the chain and is carried down the RS-232 cable to successive modules.

The WTDAC-M sells for $79.00. A data sheet is available in PDF format on the web site.

WEEDER TECHNOLOGIES
P.O. BOX 2426, DEPT. NV
FT. WALTON BEACH, FL 32549
850-863-5723
WEB: www.weedtech.com

SM2315 SERVO CONTROL

Animatics Corp., releases their latest product, the SM2315. Like other SmartMotors, the SM2315 is a controller, amplifier, and encoder built into a true brushless DC servo motor. But what sets it apart from the others is the cost, $499.00 each.

At the heart of the SM2315 is the Animatics motion control chip, a single micro-controller that handles all processing functions of the SmartMotor, including the PID loop, the trajectory generator, the user program execution, I/O control, and all communications over as many as three high-speed serial channels simultaneously.

A machine-wound stator and molded, high-energy magnet add to the savings as does a completely die-cast aluminum housing assembly.

The SM2315 was designed for high-volume applications and is already being manufactured in the thousands.

The SM2315 does nearly everything its predecessors do. The motor can be programmed to stand-alone or operate as part of an RS-232 or RS-485 network.

For more information, contact:

ANIMATICS CORP.
3050 TASMAN DR., DEPT. NV
SANTA CLARA, CA 95054
408-748-8721 FAX: 408-748-8725
EMAIL: response@animatics.com
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WAVEMAKR™

TDL® Technology, Inc., announces their WAVEMAKR™ software written to create EEPROM programming files for the Model 109 pseudo-random noise and arbitrary waveform generator.

The current version (1.20) produces 12 different waveforms including sinewave with random noise, two tone, tensine, frequency sweep, and triangle.

The program generates an ASCII-Hex file for programming the EEPROM over an RS-232 link. It also asks if you want to generate a text file which can be imported into a spreadsheet, graphing program, or edited with any ASCii file editor (and then converted to ASCII-Hex with our ASC2AHEX program).

The current version is an MS-DOS program which will also run in a DOS window in Windows 95 and 98. Just add a device=ansi.sys line to your config.sys file to get the screens to appear properly.

A Visual Basic version is being written.

The MS-DOS version is included at no charge with each Model 109. The latest version may also be freely downloaded from our web site.

For more information, contact:

TDL TECHNOLOGY, INC.
5260 COCHISE TRL., DEPT. NV
LAS CRUCES, NM 88012-9736
505-382-3173 FAX: 505-382-8810
WEB: http://www.zianet.com/tdl

SMARTMOTOR™ WITH MULTI-AXIS CONTOURING CAPABILITIES

Animatics has now added multi-axis contouring capability to its line of SmartMotors™. The SmartMotor is a single component that combines the technologies of servo motor, controller, amplifier, encoder, and PLC. This totally integrated servo motion control system delivers higher reliability, smaller foot print, and radically simplified field service. With this new contouring capability, an RS-485 network of SmartMotors can perform motion profiles as complex as multi-axis splines or as simple as circular and linear interpolation.

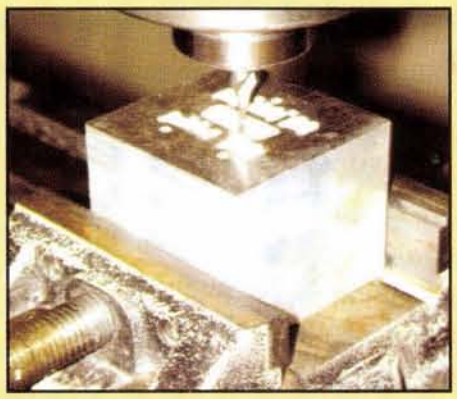
CAD and G-Code host interfaces can turn a laptop computer and three SmartMotors into a complete three-axis CNC control system on the back of the machine, without a NEMA cabinet.

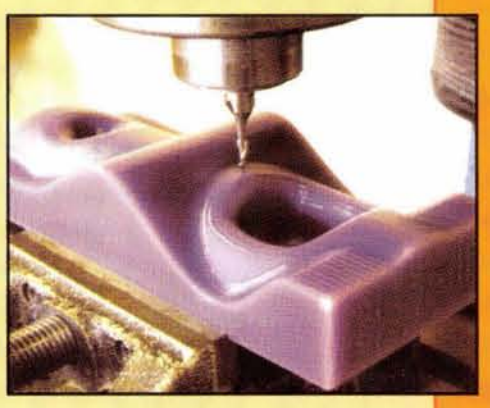
Applications that benefit from this technology range from CNC milling and turning to laser cutting and water jet cutting to glue laying or engraving. It is appropriate for any application where circular interpolation and G-Code compatibility are needed, but also where the machine builder wants a simpler, less expensive solution that is easier to support.

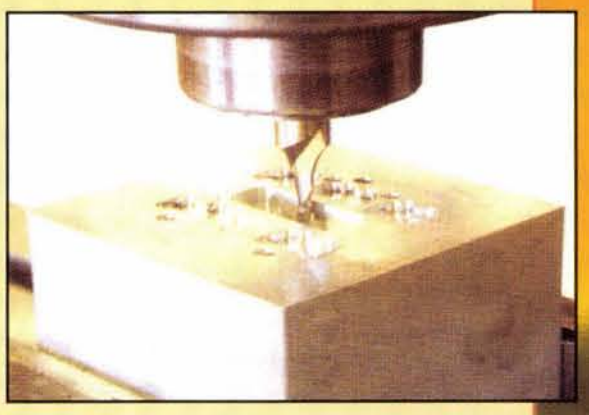
All that is needed is a PC with an RS-232 port. Animatics supplies an RS-232 to RS-485 converter, resident to the mating connector to link the chain of SmartMotors. Because bulky PC expansion cards are not used, a simple laptop will complete a system.

For more information, contact:

ANIMATICS CORP.
3050 TASMAN DR., DEPT. NV
SANTA CLARA, CA 95054
408-748-8721 FAX: 408-748-8725
EMAIL: response@animatics.com
WEB: www.animatics.com







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* DC Current Ranges: 20uA, 2mA, 20mA, 200mA, 2A, 20A
* AC Current Ranges: 20uA, 200uA, 2mA, 20mA, 200mA, 10A
* Resistance Ranges: 200 ohm, 20K ohm, 200K ohm, 2M ohm, 20M ohm
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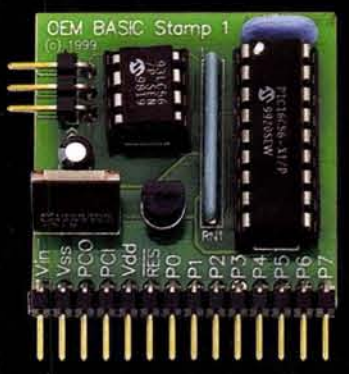

BASIC Stamp 1 OEM module $45 (#27295)

The original BS1 OEM module is available in a handy through-hole format. This module has a 3-pin header for your parallel port. The module plugs into a breadboard where it connects to +5 V, ground, and 8 I/O pins. The OEM Stamp 1 holds about 80 lines of code and executes 2,000 instructions per second.

BASIC Stamp 2 OEM module $59 (#27290)

The very popular BS2 OEM module has a DB-9 serial connector built right onto the board. All parts are socketed for easy replacement. Our PBASIC interpreter runs in a PIC16C57 and executes 4,000 instructions per second. Holds about 500 lines of code. Useful commands for serial, DTMF, and sound.

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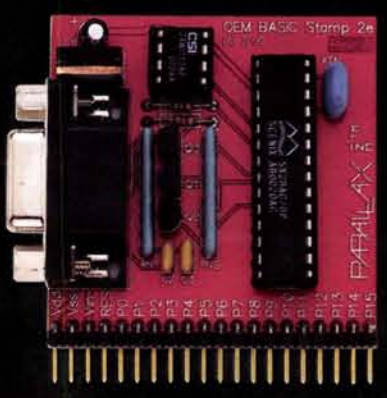

BASIC Stamp 2e OEM module $59 (#27293)

The OEM BS2e module is the solution for customers who need additional RAM and EEPROM space from a OEM Stamp 2 without the higher speed (and associated power consumption) of an OEM BS2SX module. Executes 4,000 instructions per second and holds about 4,000 lines of PBASIC code. Our interpreter runs from a SX28AC/DP.

BASIC Stamp 2sx OEM module $59 (#27294)

The OEM BS2sx is 2.5 times faster than the BS2e (left). Ideal solution for BS2 users who have needed additional program execution speed. Executes about 10,000 instructions per second and holds about 4,000 lines of PBASIC code.

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